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Railway Mechanical Engineer

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Shop Equipment Number

The June number of the *Railway Mechanical Engineer,* while giving the usual attention to the various activities of the mechanical department, will be very considerably enlarged by the addition of a section relating especially to the more efficient and economical use of railway shop equipment and machinery. A number of special studies are being made and several special contributions have been arranged for covering various improvements which are being made not only in the installation of better equipment and machine tools but also in improved methods of shop operation. A special number of this sort is of particular value at this time, when the problem of maintaining power and rolling stock is acute. The railroads have just passed through a rather severe winter and equipment has been worked under especially heavy pressure and the prospects are that this will not be relieved for a considerable time to come. Usually at this time of the year a breathing space is experienced which allows the roads to get the equipment back into first-class shape, but there is very little possibility of this being experienced during the coming months and effective measures must be taken at once to remedy this condition and be prepared for the still heavier traffic which will undoubtedly tax the railroads to the very limit of their capacity next fall and winter.

The Grain Car Situation

Although a marked improvement in the car shortage situation has been brought about in the last few weeks, the conditions are still serious and it is almost certain that when the wheat crop begins to move, the western roads will find it very difficult to obtain cars suitable for loading with grain in sufficient numbers to supply the demand. The present high price of grain makes it more important than ever to keep the loss in transit down to the minimum. Last year much difficulty was experienced in getting a supply of coopering materials. The present indications point to similar conditions this year, so it will be necessary to have cars in condition to carry grain without much special preparation if the situation is to be met satisfactorily. Although car builders have been working their plants at full capacity, the number of cars built for export has been very high, and for that reason the number of new cars available this year will not be much greater than in previous years. Aside from this, there is such a great demand for cars that they are not apt to be sent to the repair track until their condition is such that they are hardly fit for lading of any sort, and a smaller percentage of the total number of cars will be found suitable for grain. The combination of conditions which has been mentioned will undoubtedly make the grain car situation unusually serious this year. The railroads should realize the facts and in order that they may be prepared for the great demand for cars, which is to be expected when the crops start to move, they should begin at once to put as many cars as possible in condition to carry grain.

Mechanical Conventions Postponed

The Master Mechanics' and Master Car Builders' Associations, following the example of the American Railway Association, have postponed their annual conventions indefinitely. The Air Brake Association had gone so far with its plans that it was not advisable to call off the meeting which is being held this week at Memphis. Undoubtedly all of the other mechanical associations will follow the examples of the two large associations. The railways have a tremendous problem before them in taking care of the traffic which must be handled in the coming months. Nothing must be allowed to interfere with their effectiveness during this period of national crisis. While facilities of various kinds are greatly needed, it will be practically impossible to do very much in supplying them because of the scarcity of material and high prices; labor is also scarce. Wonderful results may be accomplished, however, if all the men serving in various capacities in railroad service will put forth their very best energies and give freely of their time and strength in serving the nation through a more economical and efficient operation of the railways. Experience during the past two years and a half of war in Europe has demonstrated that the transportation system forms the very backbone of the army, whether it is near the front in handling the fighting units, munition and supplies, or whether it is far away from the scene of conflict, gathering together and distributing the various supplies upon which the nations depend for their existence. Let every man in the mechanical department give of the very best that is in him.

The Railroads and the War

As a nation, we have entered upon a great enterprise. We have joined in the most gigantic struggle in the history of civilization to defend a great ideal—the ideal of human liberty. In many respects this will be the severest test to which we have ever been put as a nation. On our conduct in this struggle may depend our right to be considered the chief exponent of freedom and democracy. In this crisis every loyal American citizen has a duty to perform.

The importance of everyday activities as a factor in the conduct of war is evident today as never before. Armies and navies are but the two clenched fists of which nations themselves are the bodies. Unless the body is healthy and normal in all its functions, the striking power of the fists will soon be impaired. That the railroads play a vital part in the normal activities of the nation hardly need be called to the attention of railroad men. Events of the past few months have brought this fact into strong relief. Apparently taxed to the utmost for months past and operating under handicaps, for many of which they cannot be held responsible, they will be called to redoubled effort to play their part in the co-ordination and concentration of the nation's resources upon the prosecution of the war. To the

officers and men of the mechanical department falls the task of keeping cars and locomotives in serviceable condition to move an extraordinary volume of traffic and to do this with facilities already heavily taxed.

A national crisis such as we have entered upon always causes considerable excitement and some hysteria. No doubt, the duty of some men from every industry will lead to the firing line. That those who remain may be prepared to meet the extraordinary demands which will be placed upon them, the utmost calmness is essential. The everyday tasks of the machine shop, the boiler shop, the erecting shop and the car shop must be faithfully performed and every move must be made to count. No more patriotic duty can be performed by the men, the foremen and the officers of the mechanical department than to see that every locomotive and every car is in shape to meet the demand to come. This is essential if the railroads are not to fail in the performance of the great task before them. They must not fail!

Locomotive Brick Arch Tests

While there have been reports of road tests showing various degrees of economy derived by the use of a brick arch in the firebox of a locomotive, there never have been made what might be called scientific tests until those which were made by the Pennsylvania Railroad on its testing plant at Altoona. These tests, which are described elsewhere in this issue, were made under like conditions and show definitely the advantage a locomotive has with a brick arch over the same locomotive with no arch, operating under like conditions. The results of these tests, which are distinctly favorable to the arch, would have been still more favorable had the arch tubes in the firebox been removed with the fire brick when the "no arch" tests were made. It is well known that arch tubes play an important part in the economy of the arch. For this reason, therefore, the results shown by the tests may well be considered conservative. There were three important points disclosed by these tests. First, the value of the arch as a fuel saver; second, the increase in boiler capacity made possible by the arch, and third, that even with more complete combustion the superheat temperature of the steam was not materially increased.

These tests show that more steam will be generated than when no arch is used. The long flameway the gases are made to travel and the mass of heated brick which aids the combustion of the gases are responsible for this. While this does not mean more power in the cylinder, it does mean that the cylinders have a greater supply of steam from which to draw. This greater supply, or increase in boiler capacity, may be used in either of two ways. The cylinders may be enlarged and the power of the locomotive thus increased, or the additional supply of steam may be used in hauling trains of the same weight at faster speeds than if no arch were used.

The tests showed that the drawbar pull was greater at speeds above eight miles an hour when the locomotive was equipped with an arch, than when the arch bricks were removed. At 29 miles an hour this increase in drawbar pull was 6.4 per cent. Perhaps the most instructive diagram shown in connection with the article on these tests is Fig. 5 which gives the relation between the amount of coal fired and the horsepower at the drawbar of the locomotive. This chart shows that with 4,000 lb. of coal fired per hour, the drawbar horsepower for the locomotive equipped with the arch was 16.7 per cent greater than when the locomotive had no arch. At the higher rates of combustion, this percentage increase was not so great. When 7,000 lb. of coal was fired per hour, the increase was 11.5 per cent. This shows clearly what the arch means to the locomotive and should indicate to those roads seeking to increase their locomotive capacity, an avenue that can be easily followed. To those roads which have a large number of brick arches in service, these tests should indicate the importance of keeping the arches in first-class operative condition.

Routing Work In Railroad Shops

To secure the maximum output in a shop and to facilitate the work of supervision it is essential that there be a definite method of handling all routine work. The problem of grouping tools to secure a satisfactory routing of parts is a difficult one in a railroad shop and the output is often materially reduced by faulty arrangement.

In handling a diversified line of work, as most railroad shops did 15 or 20 years ago, when they made a large number of parts for all departments of the road, it might be advisable to group machines by classes, placing lathes in one section, planers in another, milling machines in a third, and so on. There are still a great many special jobs which must be taken care of in railroad shops, but the principal work is repairing and replacing worn parts of locomotives or cars, and for such work the location of machines should be determined by the path which it is intended to have the parts follow from the time when they are removed until they are replaced on the equipment. In a locomotive shop tools should be arranged so that wheels, driving boxes, shoes and wedges, pistons, crossheads and the other parts to be worked on can be kept moving, as far as possible, in a direct line from the point where the locomotive is stripped to the point where it is again assembled.

The arrangement of too many shops has been made on a hit-or-miss plan, similar machines being grouped in one section without regard for the movements necessary in performing the operations on the parts which the machines handle. In all large shops one planer or shaper is kept busy practically all the time finishing shoes and wedges after they have been laid off, yet how many shops have a machine located convenient to the erecting pits for that purpose?

The illogical and uneconomical location of machine tools is to be found in some shops which have been built quite recently, but for the most part it is due to the attempt to rebuild or rearrange old shops to meet present demands. Some of the costliest errors in shop layouts are the results of attempts to make extensive additions to existing shops, still retaining the old machines in their original locations. In adding machine tools the prime consideration usually is to determine where the machine can be placed with the least trouble and expense. The cost of the extra handling which this method of location makes necessary may be small for the individual parts, but repeated over and over the amount grows to such proportions that it is almost always cheaper to put the machine where it belongs in the first place, even though it necessitates considerable expense and trouble.

In one locomotive shop where it had been the practice to finish the shoe and wedge fit on driving boxes on a planer, this work was transferred to a horizontal spindle milling machine. This finished both faces with one setting, and reduced the cost of the operation materially. Shortly after the change was made the shop was called upon to deliver a much greater output. The machine tool equipment was sufficient to take care of the demand, but the crane service became overtaxed. The milling machine was some distance from the planer and boring mill on which the other operations on the boxes were performed and great difficulty was experienced in getting driving boxes finished when they were needed. The milling machine was finally moved next to the boring mill, although this necessitated the relocation of three large machines. The congestion was at once relieved, and the desired shop output was secured without difficulty. This is an extreme case, of course, but many shops are suffering, in a minor degree, from poor machine tool grouping.

A logical arrangement of machine tools alone will not ensure efficient and economical operation, but it is an important factor in attaining that end and deserves much study when changes or additions are to be made.

The Railway Equipment Situation

The railways of the United States and Canada in the first four months of 1917 placed orders for 1,288 locomotives and 29,592 freight cars as compared with 1,315 locomotives and 45,397 freight cars in the first four months of 1916. During the same four months of 1917 orders have been received from overseas for 454 locomotives and 14,550 freight cars as compared with 604 locomotives and 15,275 freight cars in the same period of 1916. It is a source of gratification that even with the great uncertainty that has characterized the past few months the purchases of equipment have kept up so well to last year's exceptionally good records.

But it is a fact that the purchasing of cars and locomotives is being retarded by the uncertainty of the present situation. The railways, however, still need cars and locomotives as much as ever. The aggregate shortage of freight cars on the railroads of the United States on April 1 as reported to the American Railway Association was 143,059. This was an increase of 12,977 over the shortage on March 1 and was not only the largest reported since the present freight congestion and shortage began last September but the largest shortage ever reported by the railroads. The American Railway Association points out that some of this shortage may represent duplications, for shippers frequently file identical orders for cars with all railroads that can take their shipments. But there is no reason to believe that there will be much improvement in the near future. The United States, having now joined the Allies, will become more than ever their base of supplies, and that can only mean that the railways will be called upon to carry greater shipments to the seaports. What demands there will be made upon the railways for troop movements does not yet appear, but if such demand should be made within the next six months or a year it will tie up cars and motive power worse than ever.

The railway mechanical departments are not in a particularly enviable position under these circumstances and there is not much reason to believe that there will be improvement until after the close of the war. For one thing, they are short of labor now and will have more and more difficulty in securing labor as the new American armies are gathered together. There will be increasing demands for repairs on cars and locomotives, and there is not much chance under present conditions that there will be new equipment to be looked forward to. The railways are feeling the uncertainty of financing, and, no doubt, the demands of the government for steel and similar materials will hinder the ready building of equipment. There is no doubt, either, that the allied countries will discontinue their foreign buying. There has been a lull for some time to be sure, but now comes the cable report that the Russian Government may buy 2,000 locomotives and 40,000 cars in America, and the more substantial information that the Baldwin Locomotive Works has recently received orders for 113 more Russian engines. The car and locomotive plants may also be called upon for the manufacture of munitions. They are already being called upon to build armored cars and may even be given orders for narrow gage cars and engines for American armies in the field. These things will certainly delay deliveries and they won't reduce prices.

The mechanical officers, however, need not look forward with feelings of fear and trepidation. They are going to be able to play a big part in helping America in this war. They are and should be already setting their house in order for the big things to come. Every car and locomotive should be put in the top notch of efficiency or in as good condition as the present conditions will allow, for the chances of making up deferred maintenance are daily going to become less and less. The demands upon railway shops are going to increase immeasurably. If the car and locomotive plants are to be handicapped the railway shops may have to build cars and locomotives themselves; many roads have already placed large orders for cars with their own shops. They will also be called upon to convert equipment to military uses. We may soon see them using some of that ingenuity for which the American railway man is famed in converting passenger equipment to ambulance trains, to commissary cars and what not.

Readjustment To Present Conditions

The mechanical departments of the railroads are now facing tremendous problems in bringing about the readjustment of their work which the recent unusual advances in the cost of labor and materials have made necessary. During the past three years the roads have experienced unprecedented increases in the cost of nearly all of the supplies they use. Furthermore, there have already been large increases in the wages of shopmen during the same time and, stimulated by the passage of the Adamson act, many of the employees are now demanding even more. It is inevitable that the cost of maintenance of equipment should rise very materially under such conditions, but a careful study should be made at this time in order to make the increase as small as possible.

At the time when the large increases in the cost of materials began, railroad mechanical men started to take energetic measures to offset them as far as possible by economy in the use of supplies. The advance in wages resulted in attempts to secure greater efficiency in the shops and the recent rise in the price of coal is now calling forth increased efforts for fuel economy. The indications are that the present high prices of materials and the present high wages will continue for a considerable length of time. While up to this time much has been done to combat the individual increases, the railroads should now look at the changes as they affect the cost of transportation in order to take the most effective steps to reduce not the individual items of expenditures, but the cost of operation as a whole.

To save wages and materials wherever possible it is especially important under the present conditions that the railroads provide sufficient equipment in shops and engine houses. The increased cost of wages justifies greater expenditures for new and improved tools, for special fixtures and for the redesigning of shops and terminals with a view to saving labor. The best of facilities for reclaiming parts should also be furnished in order that the expenditures for new material may be kept at the lowest possible figure. In spite of the high cost of shop equipment and of construction at the present time, the possibilities of savings along these lines should be carefully considered.

Attention has already been called to the necessity for the mechanical department to use every measure in its power to reduce fuel consumption, and it is not necessary to point out the various ways in which this can be accomplished. It may be that if the present high prices of fuel continue for a considerable number of years it will result in the extensive adoption of compounding combined with superheating. At the present price of coal the saving in fuel would probably offset the higher cost of repairs of the compound locomotive.

The Adamson law necessarily imposes a great burden on the railroads. To keep down as much as possible the amount of the increase in wages which the new schedule will cause it is necessary to have locomotives of high capacity. It is not enough that the locomotive be able to drag a train over the division without delays. It must have sufficient power to bring the train up to a considerable rate of speed if it is

to be an economical unit in the transportation system. Furthermore, the power must be kept in the best of condition to prevent delays which will be more expensive than ever.

Car department officers should appreciate the increased importance at this time of reducing the weight of cars wherever it can be done without an important sacrifice of strength. The cost of hauling dead weight is no inconsiderable item and a marked decrease in expenses can be made by judicious reduction in the weight of the cars. The possibility of saving empty haul by the use of cars adapted to various classes of lading should not be overlooked.

Last and most important of all, the mechanical department officers should co-operate with the officers of other departments of the railroad organization to solve the big problems now confronting them in a broad and thorough way and to take such measures as will secure the highest over-all efficiency from the railroad system.

NEW BOOKS

Proceedings of the Traveling Engineers' Association. Illustrated, 390 pages, 6 in. by 8½ in., bound in leather. Published by the association, W. O. Thompson, secretary, New York Central Lines, Cleveland, Ohio.

The Proceedings of the Traveling Engineers' Convention, which was held in the Hotel Sherman, Chicago, October 24, 25, 26 and 27, 1916, contains papers and discussions on the following subjects: The Effect of Mechanical Placing of Fuel in Locomotive Fireboxes on the Cost of Operation; Advantages of Superheaters, Brick Arches and Other Modern Appliances on Large Locomotives; Difficulties Accompanying the Elimination of Dense Black Smoke; Recommended Practice in the Make-Up and Handling of Modern Freight Trains on both Level and Steep Grades to Prevent Damage to Draft Gear; Assignment of Power from the Standpoint of Efficient Service and Economy in Fuel and Maintenance, and How Best to Educate the Road Foreman, the Engineer and the Fireman.

In connection with the remarks on firing with powdered coal, printed on page 78 of the proceedings, considerable was said in exploitation of the Powdered Coal Engineering & Equipment Company's "carburization" process. While the burning of powdered coal is feasible and has been in successful use for a number of years in metallurgical furnaces, the apparatus of this particular company is still in the experimental stage and its commercial value has yet to be determined. It is unfortunate, therefore, that the association should give its official approval by publication in its proceedings to this product, the merit of which is still undetermined. In this particular case there is further cause for regret because of the method which this company is using in exploiting its products. From its circulars and advertising matter it appears to be more interested in influencing people to buy its stock by means of extravagant theoretical claims for its product, than in developing and selling its fuel burning system.

Oxyacetylene Welding and Cutting. By P. F. Willis. Bound in cloth; 180 pages; 4 in by 6 in. Illustrated. Published by P. F. Willis, 2305 North Eleventh street, St. Louis, Mo. Price 50 cents.

In the introduction to this book the author states that his purpose in publishing it was to smooth the way for those who are starting to use the oxyacetylene process of welding and cutting. It is quite frankly the expression of the author's views on the subject, together with general information pertaining to the materials used and their production. The chapters are devoted to torches, the apparatus and its installation, preparing for welding, the welding of different metals and the welding of parts which require special treatment. While written from the standpoint of the general welding shop operator, railroad shop men who are using the oxyacetylene process will find in it much information of value to them.

COMMUNICATIONS

WHAT IS AN ENGINE FAILURE?

Chicago, Ill.

To the Editor:

In reply to the inquiry of "W. J." of Boston, published in the March issue, asking what an engine failure is, I quote below the instructions governing engine failures on one of the Western railroads:

DELAYS THAT ARE ENGINE FAILURES

Delays caused at initial terminals by waiting for locomotives, shall be considered an engine failure, except where an engine which must be turned does not arrive at the roundhouse in time to be despatched and properly cared for before leaving time.

Delays at a terminal, at a meeting point, at a junction, or delays which are responsible for delays to other traffic, caused by the locomotive breaking down, running hot, not steaming well, or by having to reduce the tonnage as a result of defects in the locomotive, shall be considered engine failures.

DELAYS THAT ARE NOT ENGINE FAILURES

If a locomotive loses time and afterwards makes it up without delaying other traffic, or being late at connecting points, no failure shall be charged.

If a passenger or scheduled freight is delayed by an engine failure and other causes, the failure shall not be considered if the locomotive makes up more time than it lost on its own account.

An engine shall not be charged with a failure if it is given excess tonnage and stalls on a hill, providing it is working and steaming well.

Delays to scheduled freight trains which make them less than 20 min. late at terminals or junction points shall not be considered failures.

Delays on extra dead freight trains shall not be considered if the run is made at an average speed of greater than 10 miles per hour.

A locomotive shall not be charged with a failure if it is delayed on account of its steaming badly or on account of leaking tubes where the locomotive has been held on side tracks for other reasons than its own defects, or where the engine has been on the road for an unreasonable length of time such as 15 hours for a run of 100 miles.

Reasonable delays caused by cleaning fires and ash pans on the road shall not be considered as failures.

A failure on a locomotive coming from an outside point to the shop for repairs shall not be considered.

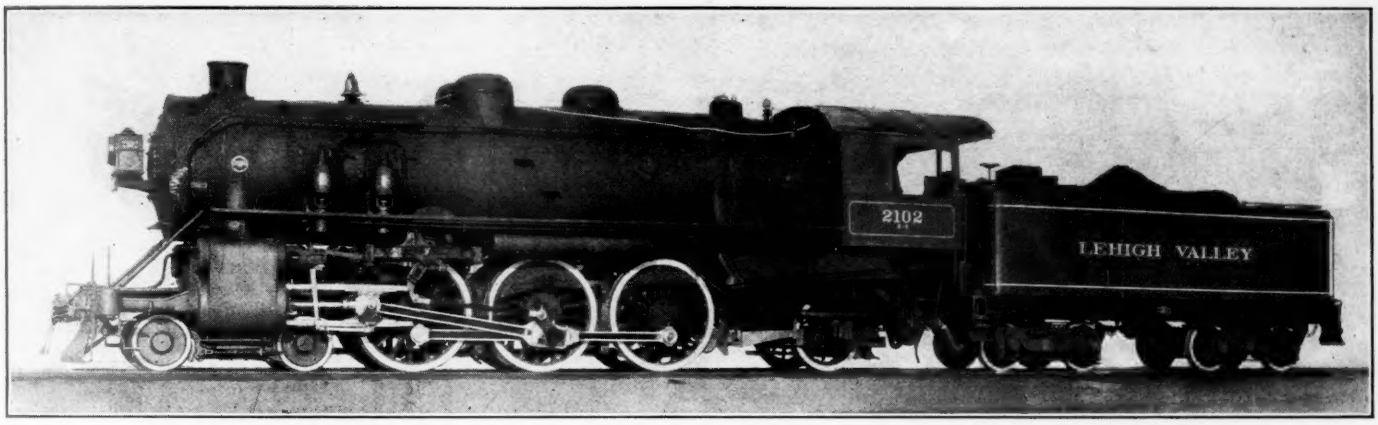
Where the transportation department is informed that a locomotive will not be ready until a stated time on account of needed repairs, failure to provide that engine before the time at which it was promised, that time shall not be considered an engine failure.

If the draft rigging on locomotives or tenders is broken on account of a sudden application of the air brakes caused by a bursting hose among the cars, or a break-in-two the accident shall not be counted as a failure.

Where a locomotive is working and steaming well, no failure shall be charged to it when it is handling fast scheduled trains under weather conditions which make it impossible to run on time.

Delays caused by locomotives running out of coal and water on account of being held between coal and water stations an unreasonable length of time, shall not be considered an engine failure.

A. B. C.



NEW POWER FOR THE LEHIGH VALLEY

Pacific Type and 2-10-2 Type Locomotives of Large Tractive Effort for Fast and Slow Freight Service

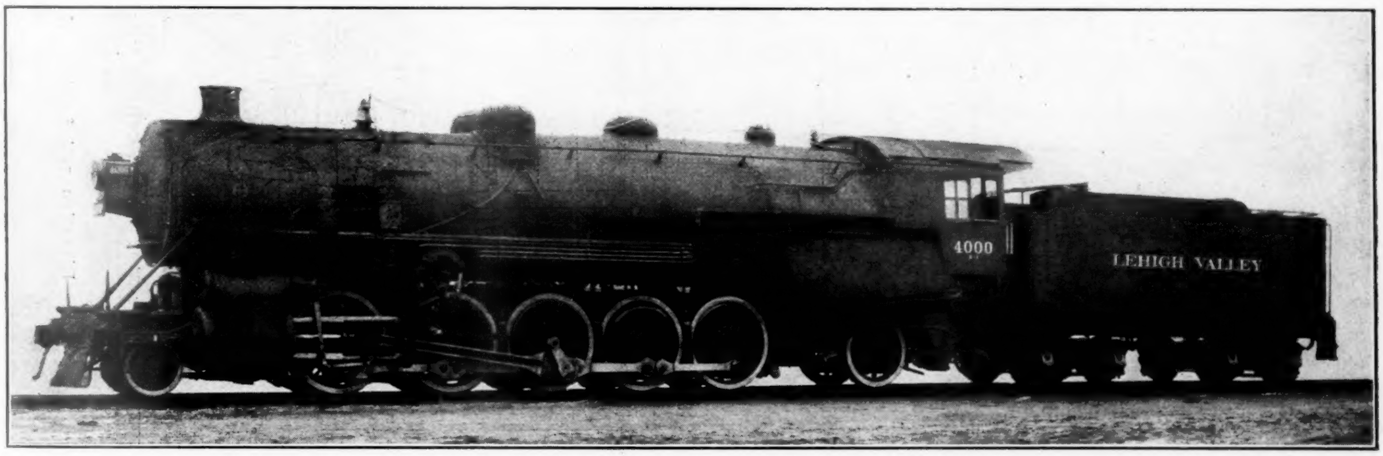
THE Lehigh Valley has reduced its train-miles in freight service on the Wyoming and Seneca divisions by the addition of 30 Powerful Pacific type locomotives and forty 2-10-2 type locomotives, built by the Baldwin Locomotive Works.

The Pacific type locomotives are used in fast freight service between Manchester, N. Y., and Coxton, Pa., which is near Pittston, a distance of 175 miles. They haul 50 loaded cars, both eastbound and westbound, and make the run in 5½ hours. By the use of these locomotives two fast freight trains which were previously hauled by heavy 10-wheel locomotives having a tractive effort of 31,000 lb., have been consolidated. From Coxton to Summit, N. Y., about 120 miles, there is a steady up-grade with many curves, the gradient running as high as 0.4 per cent. From Summit there is a down-grade to within seven miles of Manchester, where there is a steady rise with a 0.4 per cent grade 4.26 miles long. The Pacific type locomotives are also used for heavy express passenger traffic on the Wyoming division which extends between Pittston and Athens, Pa., with a maximum grade of 0.2 per cent. These locomotives are among the most powerful of their type, exerting a tractive effort of 48,700 lb., or 55 per cent greater than the tractive effort of the 10-wheel locomotives which they replace. They are designed for burning bituminous coal and differ in this respect from the greater part of the motive power on the Lehigh Valley. They resemble in many respects the latest design of the Lehigh Valley Mikado locomotives, 20 of which were built in 1916.

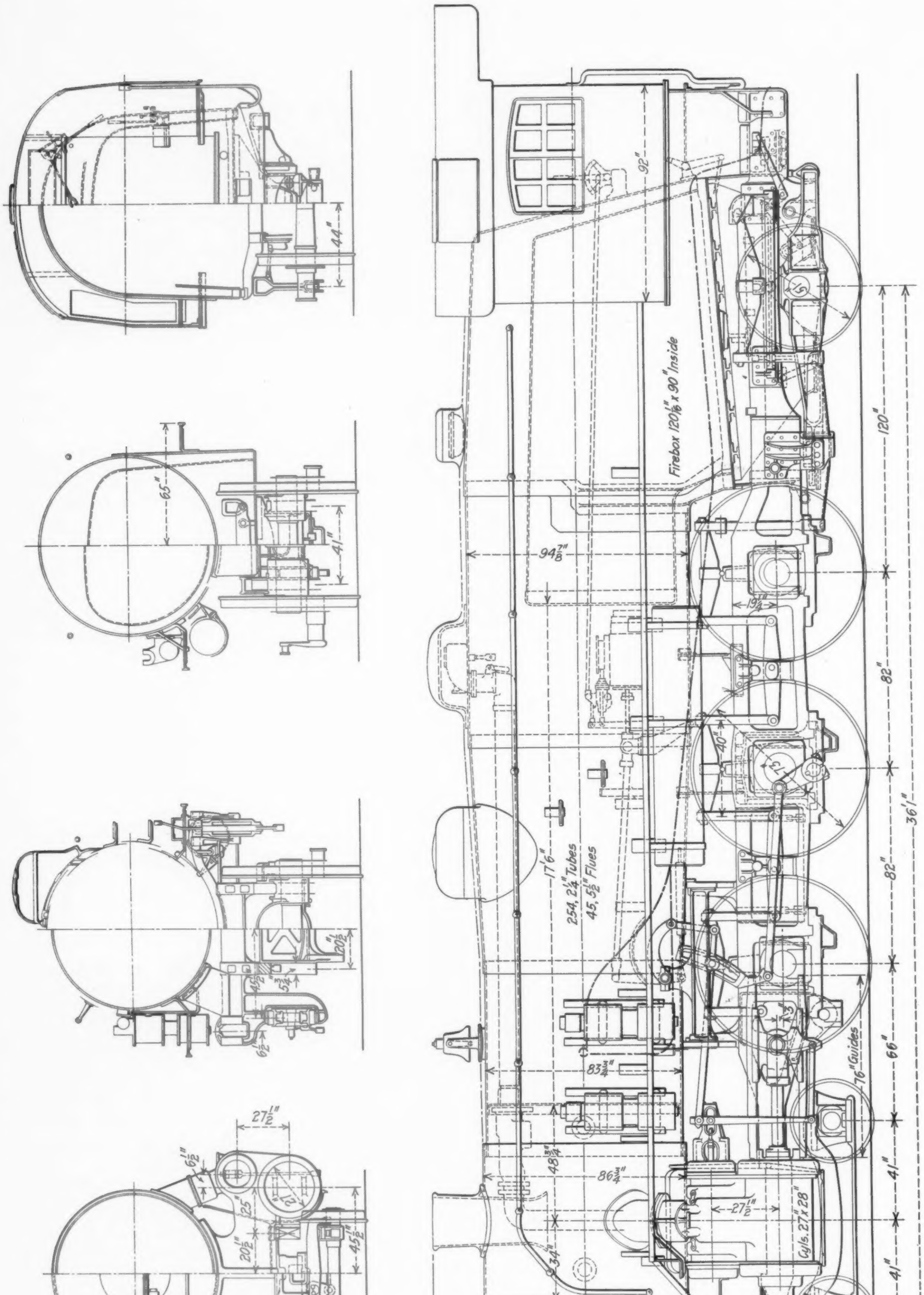
The 2-10-2 type locomotives are used in slow freight service between Manchester, N. Y., and Sayre, Pa., a distance of 88 miles, with 0.4 per cent grades. These locomotives exert a tractive effort of 72,800 lb. and will haul 4,000 tons, making this run in 6½ hours. They burn a mixture of fine anthracite and soft coal. Each locomotive replaces two heavy Consolidation locomotives, having a tractive effort of 36,000 lb. each.

The boilers of the Mikado, Pacific and 2-10-2 types are all of the same diameter at the front end and have the same number and diameter of tubes. The Mikado and the Pacific type locomotives have tubes 17 ft. 6 in. long, while the 2-10-2 type engines have tubes 21 ft. long. The fireboxes of the Mikado and Pacific type locomotives are different, in that the Mikado locomotives use a mixture of anthracite and soft coal and have 100 sq. ft. of grate area, as compared with 75 sq. ft. grate area for the Pacifics, which use soft coal. Both the 2-10-2 and the Pacific type locomotives have combustion chambers. That in the 2-10-2 is 60 in. long and that in the Pacific type is 48 in. long.

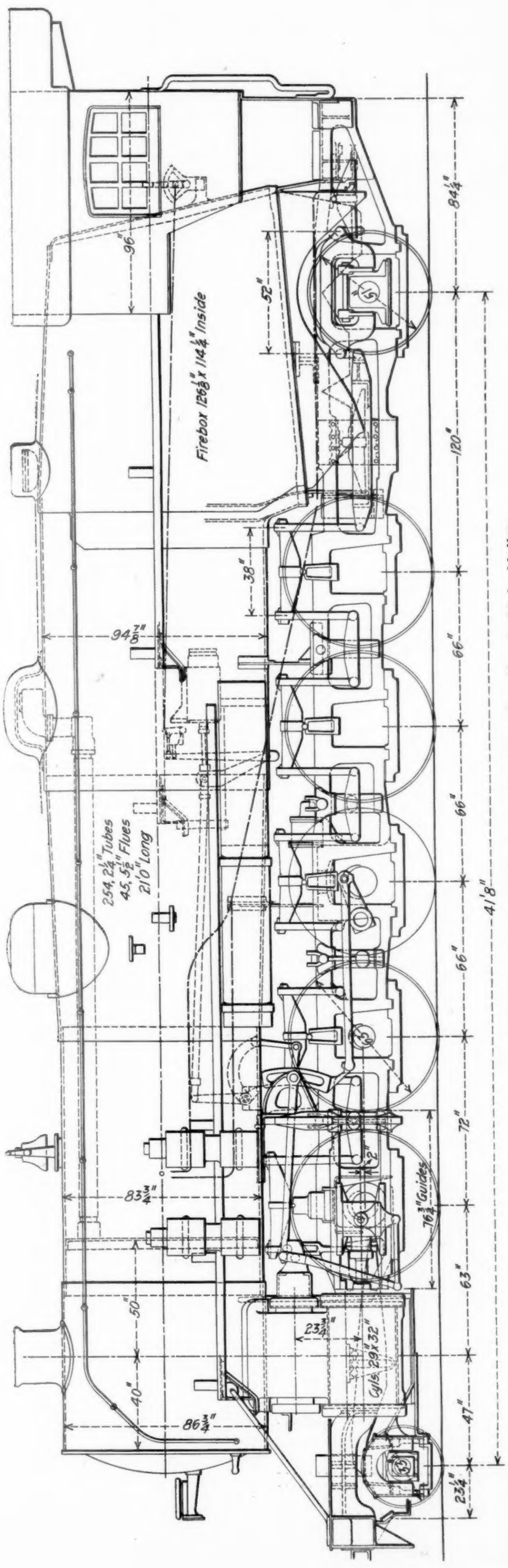
The boilers for both the Pacific and the 2-10-2 type locomotives have a conical ring in the middle course, which increases the outside diameter from 83¾ in. to 94⅞ in. The seam of the smokebox ring is welded along the top center line



Santa Fe Type Locomotive for the Lehigh Valley



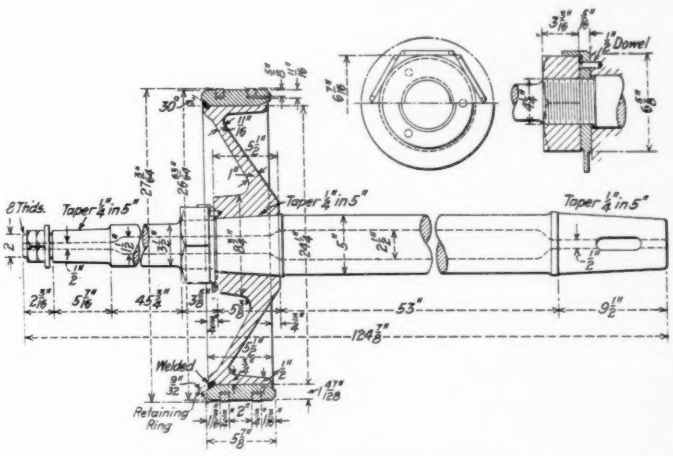
Elevation and Sections of Pacific Type Locomotive for the Lehigh Valley



Elevation of 2-10-2 Type Locomotive for the Lehigh Valley

of the boiler. The first ring has a diamond longitudinal seam on the left side center, the conical ring has a diamond longitudinal seam at the top center and the last course has a longitudinal seam on the left side just under the dome flange. The thickness of the first ring is ¾ in. and of the second and third rings 13/16 in. The front tube sheet is ⅝ in. thick and the back tube sheet ½ in. thick. A dash plate, which also supports the steam pipe, is located in the middle course of the boiler. It is 12 in. wide by ½ in. thick.

One of the interesting points in the construction of both types of these locomotives is the fact that all the seams in the firebox, including those in the combustion chamber, are welded. The side and crown sheets are in one piece, being ⅜ in. thick. The door sheet is ⅜ in. thick. Tate flexible staybolts are used extensively throughout the firebox in both locomotives. In the Pacific type locomotives there are 48 1⅛-in. Tate expansion stays, 420 rigid 1⅛-in. radial stays, 1,534 1-in. Tate flexible staybolts and 537 1-in. rigid staybolts. In the 2-10-2 type locomotives there are 56 1⅛-in. Tate expansion stays, 546 1⅛-in. rigid radial stays, 1,820 1-in. Tate flexible staybolts and 491 1-in. rigid staybolts. In the Pacific type locomotives all the stays in the combustion chamber below and including row *Y* are flexible, as are the first four rows of the crown stays. All the



Piston for Lehigh Valley Locomotive

staybolts in the sides are flexible up to and including row *B*. All the staybolts in the throat are flexible. Superheaters, brick arches and Street mechanical stokers are used in both types of locomotives. The firedoor opening is 14 in. by 26 in. and is welded the same as the other seams in the firebox, and they are equipped with pneumatically operated firedoors.

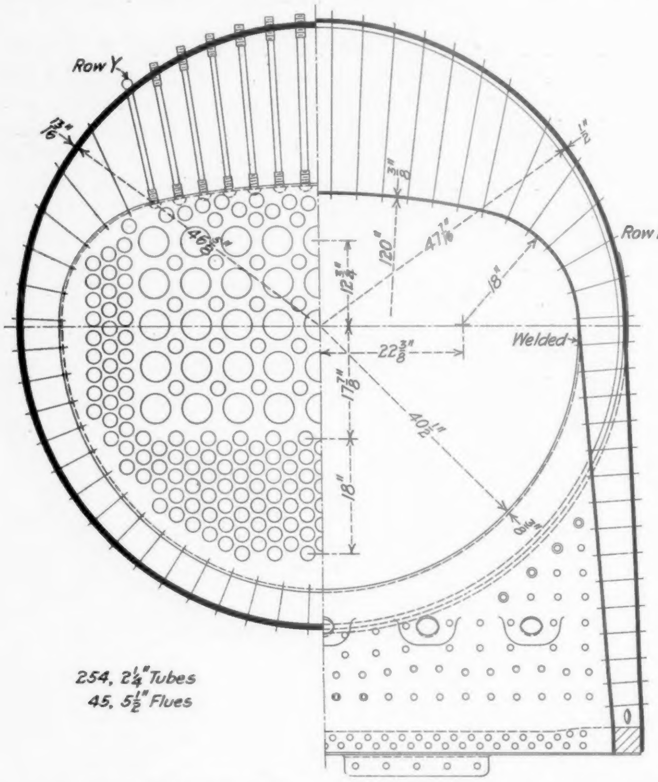
The reciprocating parts are made of special steel to reduce their weight. The piston heads are made of rolled steel of light section, being 1 in. thick at the piston rod hub and 11/16 in. thick at the outside of the web. Hunt-Spiller bull rings are held in place on the piston head by a retaining ring which is welded to the piston head. The packing rings are also of Hunt-Spiller metal. Hollow extended piston rods of Nikrome steel are used. They are held in the piston head by one nut which is provided with a special type of nut lock. This nut lock is made from a disk 5/16 in. thick in the body and ⅛ in. thick at the circumference. After the nut has been drawn up tight, this disk is cut and bent over on to the faces of the nut, as indicated in the illustration. These nut locks are made of dead soft steel and are not used more than once. Three ½-in. dowels set in the hub of the piston head keep the nut lock disk from turning. The crank-pins, connecting rods and stub straps are also made of Nikrome steel.

The cylinders are bushed, and are designed with outside steam pipe connections, and with exhaust passages of liberal

cross sectional area, free from abrupt bends. The steam chests are fitted with vacuum relief valves. When drifting, saturated steam may be admitted to the cylinders through a small pipe which leads from a shut-off valve tapped into the steam turret. This pipe is provided with a line valve conveniently placed in the cab.

The Walschaert valve gear is used on 20 of the Pacific locomotives and the Baker valve gear is used on the remaining ten. The Ragonnet power reverse mechanism is applied. The valves are set with a travel of 6 in. and a lead of 5/16 in. The steam lap is 1 3/16 in., and the exhaust clearance is 1/8 in. Thirty of the 2-10-2 locomotives are fitted with the Walschaert valve gear, while the remaining ten have the Baker valve gear. The piston valves interchange with those of the Pacific type locomotives, and the valve setting is the same, except that in the 2-10-2 locomotives the exhaust clearance is reduced from 1/8 in. to 1/32 in.

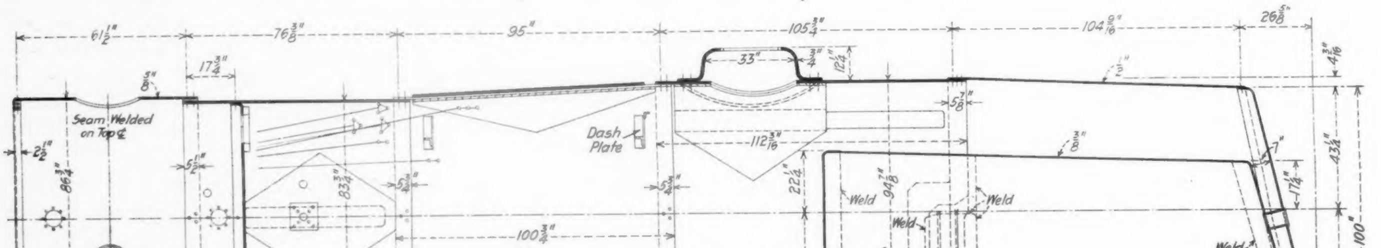
The Economy front truck is used in the 2-10-2 design, in combination with the Economy lateral motion front drivingbox. The rear truck is of the Rushton type, with inside journals. This design of truck has been applied to all the Baldwin Mikado type locomotives built for the Lehigh Valley. The reciprocating parts are similar in design to those of the Pacific type locomotives. The following is a list of the general dimensions and ratios for both types of locomotives:



Section Through the Firebox of the Pacific Type Locomotive

General Data		
Type	4-6-2	2-10-2
Service	Fast freight and heavy passenger	Freight
Fuel	Soft coal	Hard and soft coal mixed
Tractive effort	48,700 lb.	72,800 lb.
Weight in working order	301,500 lb.	370,000 lb.
Weight on drivers	197,200 lb.	289,000 lb.
Weight on leading truck	51,000 lb.	29,000 lb.
Weight on trailing truck	53,300 lb.	52,000 lb.
Weight of engine and tender in working order	458,700 lb.	540,000 lb.
Wheel base, driving	13 ft. 8 in.	22 ft. 6 in.
Wheel base, total	36 ft. 1 in.	41 ft. 8 in.
Wheel base, engine and tender	68 ft. 10⅜ in.	74 ft. 6 in.
Ratios		
Weight on drivers ÷ tractive effort	3.9	4.0
Total weight ÷ tractive effort	6.2	5.1
Tractive effort × diam. drivers ÷ equivalent heating surface*	639.2	685.0
Equivalent heating surface* ÷ grate area	74.3	66.9
Firebox heating surface ÷ equivalent heating surface,* per cent.	6.6	6.6
Weight on drivers ÷ equivalent heating surface*	34.5	43.2
Total weight ÷ equivalent heating surface*	54.1	55.3
Volume both cylinders	18.6 cu. ft.	24.5 cu. ft.
Equivalent heating surface* ÷ vol. cylinders	300.6	273.
Grate area ÷ vol. cylinders	4.0	4.1
Cylinders		
Diameter and stroke	27 in. by 28 in.	29 in. by 32 in.
Valves		
Kind	Piston	Piston
Diameter	14 in.	14 in.
Greatest travel	6 in.	6 in.
Wheels		
Driving, diameter over tires	73 in.	63 in.
Driving, thicknes of tires	3½ in.	3½ in.
Driving journals, main diameter and length	13 in. by 20 in.	13 in. by 20 in.
Driving journals, front, diameter and length	....	11 in by 20 in.
Driving journals, others, diameter and length	11 in. by 14 in.	11 in. by 14 in.
Engine truck wheels, diameter	33 in.	33 in.
Engine truck, journals	7 in. by 12 in.	7 in. by 12 in.
Trailing truck wheels, diameter	51 in.	51 in.
Trailing truck, journals	9 in. by 14 in.	9 in. by 14 in.
Boiler		
Style	Conical	Wagon-top
Working pressure	205 lb. per sq. in.	200 lb.
Outside diameter of first ring	83¾ in.	83¾ in.
Firebox, length and width (ins.)	120 1/16 by 90	126⅛ by 114¼
Tubes, number and outside diameter	254, 2¼ in.	254, 2¼ in.
Flues, number and outside diameter	45, 5½ in.	45, 5½ in.
Tubes and flues, length	17 ft. 6 in.	21 ft.
Heating surface, tubes and flues	3,734 sq. ft.	4,485 sq. ft.
Heating surface, firebox	369 sq. ft.	438 sq. ft.
Heating surface, total	4,103 sq. ft.	4,923 sq. ft.
Superheater heating surface	980 sq. ft.	1,179 sq. ft.
Equivalent heating surface*	5,573 sq. ft.	6,691.5 sq. ft.
Grate area	75 sq. ft.	100 sq. ft.
Tender		
Weight	157,200 lb.	170,000 lb.
Wheels, diameter	36 in.	36 in.
Journals, diameter and length	5½ in. by 10 in.	6 in. by 11 in.
Water capacity	8,000 gal.	9,000 gal.
Coal capacity	12½ tons	15 tons

* Equivalent heating surface = total evaporative heating surface + 1.5 times the superheating surface.



Boiler for Lehigh Valley Pacific Type Locomotives

Locomotive Brick Arch Tests

Comparative Test Plant Results Show That Brick Arches Increase Drawbar Horsepower From 12 to 16 Per Cent

THE importance of the brick arch to locomotive operation was never made more apparent than by the extensive tests recently conducted on the locomotive test plant of the Pennsylvania Railroad, the results of which are published in its Bulletin No. 30.* While numerous road tests have been made on different railroads showing a saving of fuel, an increase in boiler capacity and a reduction in smoke by the use of the brick arch, there has nowhere been available as complete and definite information regarding the advantages of the brick arch on modern locomotives as contained in this bulletin.

The tests were made on a Mikado locomotive (Class Lls) of the following general dimensions:

Weight in working order	320,700 lb.
Weight on drivers	240,200 lb.
Cylinders (diameter and stroke)	27 in. by 30 in.
Driving wheel diameter	62 in.
Heating surface, tubes (water side)	3,713.8 sq. ft.
Heating surface, tubes (fire side)	3,372.0 sq. ft.
Heating surface, firebox (fire side)	305.97 sq. ft.
Heating surface, superheater (fire side)	1,233.24 sq. ft.

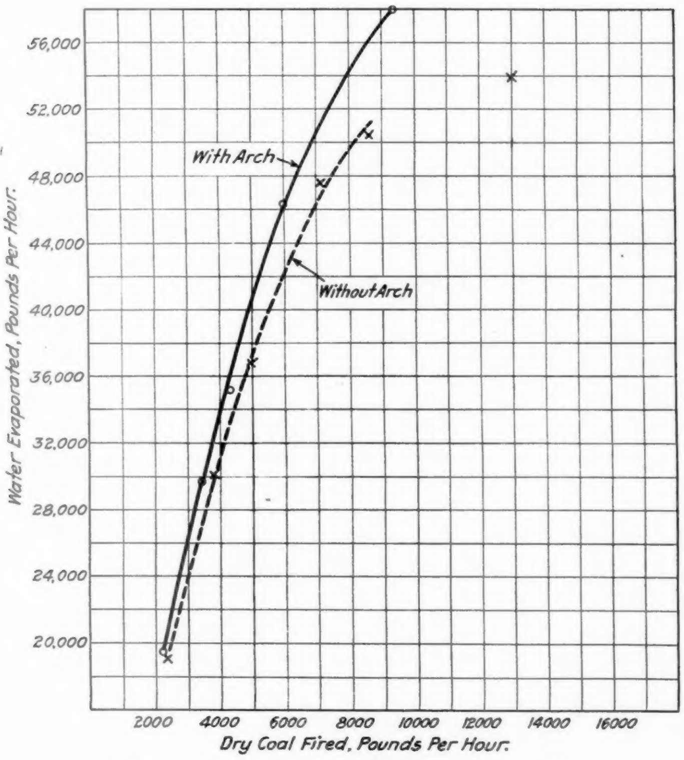


Fig. 1—Coal Fired and Water Evaporated

Heating surface, total (fire side)	4,911.21 sq. ft.
Grate area	70.27 sq. ft.
Boiler pressure	205 lb.
Small tubes, number and diameter	236—2¼ in.
Large tubes, number and diameter	40—5½ in.
Tube length	18 ft. 11 in.

Ratios

Total heating surface ÷ grate area	69.00
Fire area through tubes ÷ grate area	0.12
Firebox heating surface ÷ grate area	4.35
Tube heating surface ÷ firebox heating surface	11.02

Five tests were made with a Security sectional brick arch in the firebox and six were made with the arch brick removed to show the evaporative range of the locomotive in both cases. Of the five arch tests, two were made at a speed of 14.5 m. p. h., one with a 30 per cent cut-off and the other with a 50 per cent cut-off; two were made at 21.7 m.p.h., one with a 50 per cent cut-off and the other with a 60 per cent cut-off, and one was made at 28.9 m.p.h. with a 65 per cent cut-off. In the tests without the arch the same program was followed with the addition of a test at 28.9 m.p.h. with a 60 per cent cut-off.

The brick arch was supported on four water tubes, 3 in. in diameter. It extended 6 ft. 4 in. from the tube sheet, or to a point 4 ft. 4¾ in. from the rear water leg of the firebox. The minimum distance between the crown sheet and the top of the arch was 20¾ in.

While the tests were made to determine the effect of the brick arch on the boiler, the engine and the locomotive itself, no consideration was given the arch tubes, which were left in the firebox for both sets of tests. This must be kept in mind throughout the following discussion as it has been demonstrated that the arch tubes play no small part in the increase in efficiency attributed to the brick arch. Other experimenters have found that the arch tubes alone by their added heating surface and the increased circulation of the water are responsible for a saving in the boiler efficiency of approximately one per cent per tube. The advantages shown for the brick arch in these tests would undoubtedly have been greater had the arch tubes been removed with the bricks in the "no arch" tests.

All of the tests were fired by hand with Jamison coal, which had passed over a screen having 1¼ in. openings and both series of tests were fired with coal from the same car. This is a Pennsylvania high volatile bituminous coal from the Latrobe region, Pittsburgh vein and, except in being screened instead of run of mine, it is fairly representative of the coal used in freight service on Pennsylvania locomotives. An approximate analysis of coal used in the tests follows:

Fixed carbon, per cent	54.00
Volatile matter, per cent	31.00
Moisture, per cent	0.92
Ash, per cent	14.08
Total	100.00
Sulphur, separately, per cent	1.14
Calorific value, B. t. u. per lb. of combustible	15,258
Calorific value, B.t.u. per lb. of dry coal	13,088

The fact that the fuel used was not run of mine is another feature which should be considered, especially from the fuel consumption standpoint. With run of mine coal and no arch there is a loss of fuel because of a certain percentage of the fine particles passing out through the tubes unconsumed. With the arch a large proportion of these particles will doubtless be consumed during their passage over the brick work.

BOILER PERFORMANCE

From the standpoint of the boiler, the tests show that with the arch there was an appreciable increase in the draft, especially at the high rates of combustion; that there was an increase in firebox and smokebox temperatures; an increase in evaporation at all rates of combustion; a decrease in smoke density; an improved equivalent evaporation per pound of dry coal and a material increase in boiler efficiency.

Draft.—The nozzle used was common to Pennsylvania practice. It had four projections which might be considered partial bridges and its area was equivalent to a round nozzle of 7 in. diameter. Draft readings were taken in the ashpan, the firebox and both back of and in front of the diaphragm. The arch had but little effect on the draft in the ash pan, but the difference in the firebox was noticeable. At the diaphragm the difference was still more pronounced, being 25 per cent greater in front of the diaphragm and 30 per cent

greater back of the diaphragm when the rate of firing was 100 lb. of dry coal per square foot of grate per hour. The reason for this increase is due to the longer path for the products of combustion when the arch is used. It was also found that the draft was increased at all rates of equivalent evaporation per square foot of heating surface.

Firebox and Smokebox Temperatures.—The temperature in the firebox varied between 2,363 and 2,820 deg. F. with the arch and between 2,050 and 2,610 deg. F. without the arch for the different rates of combustion. Through the average rates of fuel combustion, the increase in firebox temperature due to the arch was 100 deg. F. This difference for the smokebox was about 30 deg. F. The smokebox temperature varied from 456 to 609 deg. F. with the arch and 426 to 529 deg. F. without the arch.

Evaporation.—Fig. 1 shows how the arch increases the amount of water evaporated for all rates of combustion. At combustion rates between 4,000 and 6,000 lb. of dry coal per hour, the percentage increase in evaporation is nine per cent. Had the arch tubes been removed and run of mine coal used instead of screened lump, this difference would have been greater. There is shown in this chart a point corresponding to a fuel rate of 13,000 lb. an hour. This was made

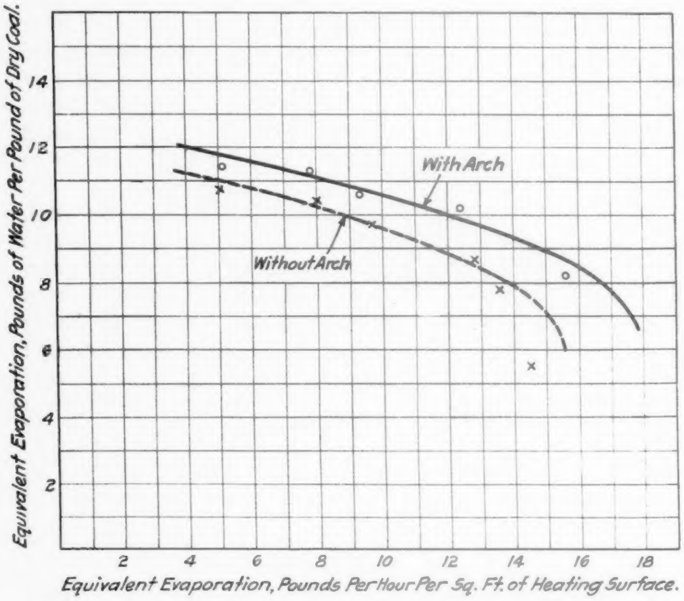


Fig. 2—Rate of Evaporation and Evaporation per Pound of Coal

in test 5,015, the data for which is shown in the table. During this test the locomotive was driven far beyond its true or normal capacity without an arch; in other words the fuel was fired at such a rate that the efficiency of combustion fell off greatly. It is interesting to observe that the locomotive evaporated 54,000 lb. of water per hour at a fuel rate of about 8,000 lb. with the arch, while without the arch a fuel rate of 13,000 lb. was required to evaporate the same amount of water. It will be seen that at this high rate of combustion in the no arch test, it was only possible to maintain a boiler pressure of 185 lb., that only 4.1 lb. of water was evaporated per lb. of dry fuel, that the boiler efficiency was only 40.6 per cent, that 76 per cent smoke was produced and that 5.4 lb. of fuel was required per drawbar horsepower. This is again shown in Fig. 5, which gives the amount of coal fired per drawbar horsepower.

By referring the data to an equivalent evaporation from and at 212 deg. basis, the results show a saving for the arch of from six to ten per cent as the firing rate is increased from minimum to maximum. By plotting the equivalent evaporation of water per hour per square foot of heating surface against the equivalent evaporation of water per pound of coal (Fig. 2) it is found that the arch effected an increase in the evaporation per pound of dry coal ranging between 7.4 and 18 per cent as the evaporation per square foot of heating surface was increased from 5 to 14 lb.

Boiler Efficiency.—The increase in boiler efficiency by the use of the arch is illustrated in Fig. 3. It is plotted against the rate of combustion. The variation is very nearly constant throughout the range of combustion shown, but the percentage increase varies between 6.9 and 11.6 per cent as the rate of firing is increased from 35 to 120 lb. of dry coal per square

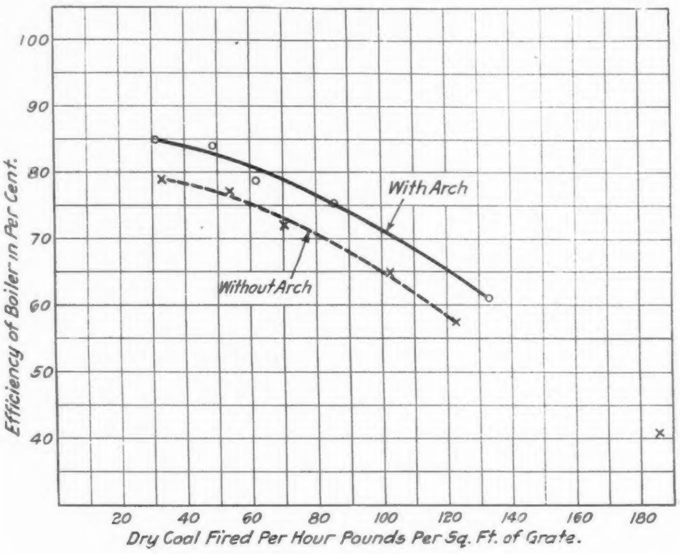


Fig. 3—Rate of Firing and Efficiency of Boiler

foot of grate surface. Comparing the efficiency on the basis of water evaporated per hour, the arch shows a higher boiler efficiency at all rates of combustions.

ENGINE PERFORMANCE

Since, as stated above, the degree of superheat is not increased by the use of the brick arch, it has no direct effect on the engine economy. It does, however, produce an increase in power on account of the greater evaporation, which

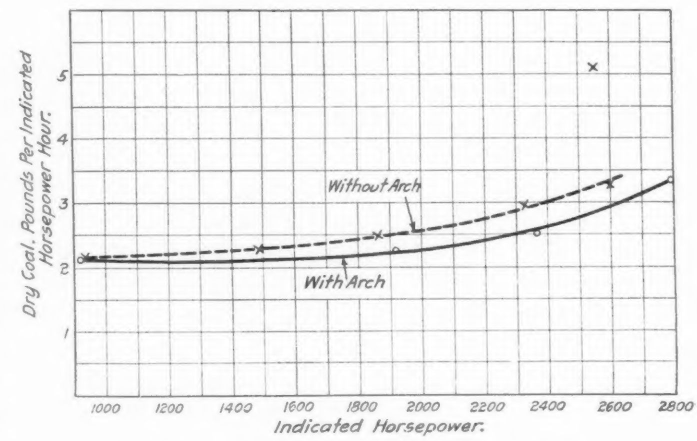


Fig. 4—Indicated Horsepower and Coal Rate

means that a train of a certain tonnage can be hauled at greater speeds than if no arch were used. It will also permit of increasing the size of cylinder if greater hauling capacity is desired. Further, the use of the arch will decrease the fuel consumption for the same train load operating at the same rate of speed as compared to the locomotive without the arch. Fig. 4 shows the relation between the indicated horsepower and the rate of combustion. The increase due to the arch varies from zero at light loads, to 12 per cent at maximum power.

The maximum indicated horsepower obtained with the arch was 2,790 at the 28.9 m.p.h. and with 63.5 per cent cut-off, while with the arch removed but 2,603 indicated horsepower was developed at this speed with a 60.1 per cent cut-off. In test No. 5,015 in which the locomotive without an arch was fired at an excessive rate which reduced the efficiency of combustion, but 2,551 indicated horsepower was obtained with a 64.2 per cent cut-off. In this case the arch test

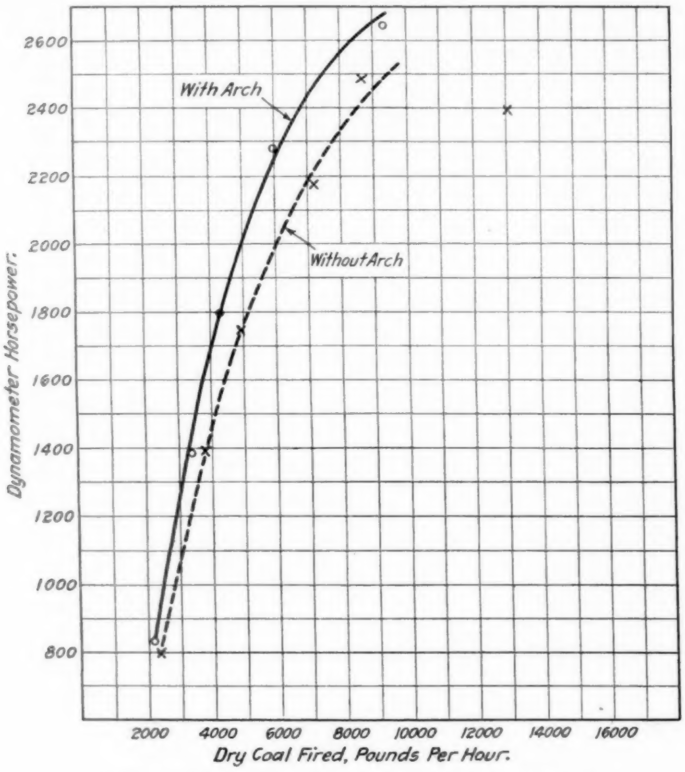


Fig. 5—Coal Fired and Dynamometer Horsepower

showed an increase in indicated horsepower of 9.4 per cent over the test without the arch; at the same time the test without the arch required 39.5 per cent more coal fired per square foot of grate surface per hour than the test with the arch.

LOCOMOTIVE PERFORMANCE

The effect at the drawbar of the use of the brick arch is to decrease the coal consumption per drawbar horsepower and to raise the maximum drawbar horsepower. Both of these results are well illustrated in Fig. 5. The percentage increase over the no arch locomotive in drawbar horsepower for different rates of combustion taken from the curve in Fig. 5 is as follows:

Coal fired	Drawbar horsepower: Arch	Drawbar horsepower: No arch	Difference	Percentage Difference
3,000	1,250	1,080	170	15.7
4,000	1,680	1,440	240	16.7
5,000	2,000	1,750	250	14.3
6,000	2,250	1,990	260	13.1
7,000	2,430	2,180	250	11.5

The additional power made possible by the use of the arch gives an increase in drawbar pull at speeds above 8 m.p.h.

A point indicates the fuel rate of 13,000 lb. an hour in Fig. 5. This is from test 5,015 referred to above and plainly indicates the break in the curve for the no arch test. No such break is indicated for the arch test and it would have been interesting had these tests been carried further to determine where a similar break would occur with the arch.

In reviewing these tests, attention has been called to the fact that a coal high in volatile matter was used. Tests conducted on the Pennsylvania testing plant a number of years ago with an improvised form of arch without water tubes and with a similar grade of coal, and also a coal having less volatile combustible, indicated that the advantages of the arch were not so great with low volatile fuel. In both these tests and the tests described above, it was found that the excellent results obtained with the arch are due principally to the mass of the heated brick in the firebox and the long passage the heated gases are made to travel. In both cases more complete combustion is obtained before the products of combustion reach the tubes than when no arch is used. A brick arch placed in the firebox of a locomotive is, therefore, of considerable advantage as less fuel is required per unit of work done and the capacity of the boiler is increased.

SAVING EFFECTED BY BREAKING SCRAP

Although the management of every railroad attempts to produce transportation at the lowest possible cost and great care is taken to secure the maximum efficiency in shop operation, in the complex organization of the railroad, the minor factors are apt to be slighted and there is a tendency to overlook the possibilities of securing increased revenue from those sources which might be called the by-products of transportation. An interesting instance of saving effected in an unusual manner is the practice of breaking scrap before disposing of it which has recently been instituted by the Buffalo, Rochester & Pittsburgh. So far as we have been able to ascertain there are very few roads which are following this practice, but the method is so profitable that it will, no doubt, be adopted wherever scrap is handled in considerable quantities.

Large castings, such as cylinders, driving wheel centers,

Test number	5,006	5,017	5,007	5,012	5,008	5,013	5,009	5,014	5,010	5,016	5,015
Brick arch?	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	No
Revolutions per min	80	80	80	80	120	120	120	120	160	160	160
Cut-off (per cent)	30	29.6	47	47.9	47.2	47.3	58.3	57.6	63.5	60.1	64.2
Duration of test (hours)	2.00	2.00	2.00	2.00	1.00	1.00	1.00	1.00	1.00	0.75	0.50
Speed (m. p. h.)	14.5	14.4	14.5	14.5	21.7	21.7	21.7	21.7	28.9	28.9	28.9
Boiler pressure (lb.)	204.6	205.2	205.2	205.0	205.3	205.4	204.6	204.4	204.3	202.5	185.0
Dry fuel fired (lb. per hr.)	2,179	2,304	3,391	3,758	4,309	4,922	5,999	7,175	9,332	8,624	13,018
Dry fuel fired per hr. per sq. ft. of grate	31.0	32.8	48.3	53.5	61.3	70.0	85.4	102.1	132.8	122.7	185.3
Water delivered to boiler (lb. per hr.)	19,493	18,991	29,661	30,150	35,138	36,676	46,370	47,570	58,227	50,395	53,898
Water evaporated per lb. dry fuel	9.0	8.2	8.8	8.0	8.2	7.5	7.7	6.6	6.2	5.8	4.1
Equivalent evaporation:											
Per hr. per sq. ft. heating surface	5.1	5.0	7.8	8.0	9.3	9.7	12.4	12.8	15.6	13.6	14.5
Per lb. dry fuel	11.4	10.7	11.3	10.4	10.6	9.7	10.2	8.7	8.2	7.8	5.5
Boiler horsepower	722	711	1,112	1,133	1,325	1,384	1,767	1,818	2,226	1,936	2,062
Efficiency of boiler	84.8	79	83.9	77.1	78.7	71.9	75.4	64.8	61.0	57.5	40.6
Dry steam to engines (lb. per hr.)	17,513	16,931	27,861	27,360	34,976	34,516	46,260	45,598	58,163	49,701	53,898
Indicated horsepower	926	938	1,486	1,491	1,918	1,866	2,364	2,333	2,790	2,603	2,551
Dry fuel per i. hp. hr	2.11	2.19	2.14	2.29	2.25	2.48	2.53	2.95	3.34	3.27	5.10
Dry steam per i. hp. hr	18.93	18.06	18.74	18.35	18.23	18.50	19.56	19.55	20.84	19.10	21.13
Drawbar pull (lb.)	21,602	20,936	35,907	36,120	31,004	30,193	39,362	37,586	34,284	32,218	31,070
Drawbar horsepower	834	803	1,386	1,394	1,795	1,748	2,279	2,176	2,646	2,487	2,398
Dry fuel per d. b. hp. hr. (lb.)	2.4	2.6	2.3	2.5	2.4	2.7	2.6	3.2	3.5	3.4	5.4
Dry steam per d. b. hp. hr. (lb.)	21.0	21.1	20.2	19.6	19.5	19.8	20.3	21.0	22.0	20.0	22.5
Machine efficiency of locomotive (per cent)	90.0	85.6	93.2	93.5	93.6	93.7	96.4	93.4	94.8	95.5	94.0
Thermal efficiency of locomotive (per cent)	8.3	7.6	8.5	7.9	8.1	7.3	7.4	6.2	5.5	5.7	3.6

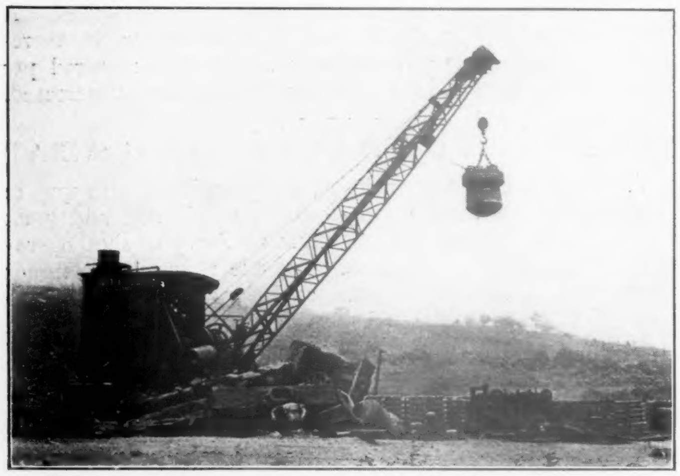
deck castings, etc., cannot be sold to foundries and are usually bought by scrap dealers, who must unload the castings, break and reload them, also paying freight charges. As under ordinary conditions the broken scrap brings about $14 a ton and the unbroken castings only $8 a ton, the business of breaking up the castings is profitable for the scrap dealer, but it is still more profitable for the railroads, who do not have the cost of the extra handling and the freight charges to meet.

The road above mentioned is now making a practice of carrying all large castings to a pit, where they are broken by dropping a large weight on them, a 15-ton locomotive crane being used to raise the weight and also to handle the castings when necessary. About 26 tons of castings may be broken in a day, the cost per day for operation of the hoist being as follows:

Engineer, 10 hrs. at 34 cents	$3.40
Coal, ½ ton at $1.25	.63
Valve oil, one pint at 48 cents per gal	.06
Engine oil, 1 qt. at 28 cents per gal	.07
Miscellaneous supplies	.10
Repairs, including general repairs	.91
	$5.17

Interest and depreciation are not included in these figures and if they were added, the cost of operation would be between $8 and $10 a day.

The locomotive crane is, of course, used for general service and the only special equipment required for breaking scrap



Locomotive Crane Breaking Large Scrapped Castings

is two weights, the larger weighing 8,000 lb. and the smaller 3,500 lb. These have convex bottoms for breaking the castings, while the tops are flat to enable the magnet to catch them readily.

Taking the maximum figure of $10 a day as the cost of operation of the hoist, the cost of breaking scrap is as follows:

Cost of hoist per day	$10.00
Labor, one helper at 20 cents per hour	2.00
	$12.00

The value of the scrap is:

Broken scrap, 26 tons at $14 per ton	$364.00
Unbroken scrap, 26 tons at $8 per ton	208.00
Increase in value	$156.00
Cost of breaking	12.00
Net gain by breaking scrap	$144.00

Of course this saving is not made every day, as it is only about once a month that a carload of large scrap accumulates, but the gain in a year's time is a considerable item. It would seem a measure of economy for all railroads to break their large scrap castings, even though circumstances required the use of a much less efficient method than that herein described.

PROMPT ACTION BY THE RAILWAYS IN THE WAR

Plans for the co-ordination of activities of the railways of the United States so that they will be operated practically as a single system in meeting the transportation needs of the country were adopted at a meeting of more than 50 railway executives held at Washington, April 11, at the call of Daniel Willard, president of the Baltimore & Ohio, and chairman of the Advisory Commission Council of National Defense. General authority to formulate the policy of operation was placed in the hands of a special committee on National Defense of the American Railway Association, of which Fairfax Harrison, president of the Southern Railway, is chairman. This committee consists of 28 railway executives and it is divided into six departments, each to correspond with one of the military departments of the army, and its work will be supervised by a central executive committee to sit at Washington, comprised of Mr. Harrison; Samuel Rea, president, Pennsylvania Railroad; Howard Elliott, chairman, New York, New Haven & Hartford; Julius Kruttschnitt, chairman executive committee, Southern Pacific; and Hale Holden, president, Chicago, Burlington & Quincy, with Mr. Willard as a member ex officio.

At this meeting the following resolutions were adopted:

"Resolved, that the railroads of the United States, acting through their chief executive officers here and now assembled, and stirred by a high sense of their opportunity to be of the greatest service to their country, in the present national crisis, do hereby pledge themselves, with the Government of the United States, with the governments of the several states, and with one another, that during the present war, they will co-ordinate their operations in a continental railway system, merging during such period all their merely individual and competitive activities in the effort to produce a maximum of national transportation efficiency. To this end they hereby agree to create an organization which shall have general authority to formulate in detail and from time to time a policy of operation of all or any of the railways, which policy, when and as announced by such temporary organization, shall be accepted and earnestly made effective by the several managements of the individual railroad companies here represented."

For some time past, the Special Committee on National Defense of the American Railway Association, which was appointed at the request of President Daniel Willard of the Baltimore & Ohio as chairman of the committee on transportation and communication of the Advisory Commission of the Council of National Defense, has been working in co-operation with the office of the quartermaster general of the army of the United States, making plans to promote, in case of war, the effective use of the country's transportation facilities. These preliminary plans have now been completed and the general principles on which they have been based are explained in a statement issued by Fairfax Harrison, president of the Southern Railway, and general chairman of the Special Committee on National Defense, as follows:

"The plan of operation worked out here is in distinct contrast to that adopted in England at the outset of the war. There the government immediately assumed the responsibility for the operation of the railroads and exercised its authority to that extent through a committee composed of the heads of the principal lines. The government guaranteed that the net earnings of the companies would continue to be what they had been before the war started.

"In this country the plan is that the government shall advise the railroads what service it requires and the responsibility will be upon the railroad managers to provide that service. When working to that end the railroads of the country will be operated practically as one system.

"It is planned to place the responsibility upon experienced

railroad officers for producing results and the government's only function is to determine what the requirements are. It is the belief of railroad companies that this will not only work for efficiency of service but for economy in cost as well. The above plan of co-operation between the government and the railways is most desirable as the latter are keenly appreciative of this opportunity to demonstrate to the country at large the value in time of war of railroads with elastic management.

"It is believed that the transportation companies will be able to afford to the government expeditiously all the service it may require without substantial interference with the commercial interests of the country. The government's business will receive preferential movement, but it is not anticipated that ordinary traffic will experience abnormal delays."

Sub-committees have been appointed from various branches of railway service. They are as follows: Military Equipment Standards; Commission on Car Service; Military Transportation Accounting; Military Passenger Tariffs, and Military Freight Tariffs.

J. T. Wallis, general superintendent motive power, Pennsylvania Railroad, is chairman of the Military Equipment Standards sub-committee and associated with him on this sub-committee are: C. E. Chambers, superintendent motive power, Central of New Jersey; C. A. Lindstrom, assistant to president, Pressed Steel Car Company; F. W. Mahl, director of purchases, Southern Pacific; Peter Parke, chief engineer, The Pullman Company; R. E. Smith, general superintendent motive power, Atlantic Coast Line; C. B. Young, mechanical engineer, Chicago, Burlington & Quincy.

One of the important studies to be made by this committee is that of adapting existing cars to meet the needs of military service.

J. T. Wallis
General Superintendent of Motive Power, Pennsylvania Railroad

C. E. Chambers
Superintendent of Motive Power, Central R.R. of New Jersey

C. A. Lindstrom
Assistant to President, Pressed Steel Car Company

F. W. Mahl
Director of Purchases, Southern Pacific

Peter Parke
Chief Engineer, Pullman Company

R. E. Smith
Gen Superintendent of Motive Power, Atlantic Coast Line

C. B. Young
Mechanical Engineer, Chicago, Burlington & Quincy

McCLELLON WATER-TUBE FIREBOX

A water-tube firebox designed primarily to reduce the cost of maintenance and which also increases the firebox heating surface, has been in the process of development for a number of years by James M. McClellon, of Everett, Mass. A few years ago one was built and applied to a Boston & Maine locomotive. From the experience gained by that installation another design has been made and two have been applied to locomotives on the New York, New Haven & Hartford. It has been the aim of the designer to eliminate the use of staybolts and to divide the firebox into individual units which may better resist the expansion and contraction forces in service and which may be renewed with but little difficulty. The only staybolts used in the firebox are in the throat and the foundation or mud ring, which is a chamber 7½ in. by 6 in., extending along the sides and back of the firebox. The sides and back-head are made up of 6 in., 5⅜ in. and 5 in. water tubes, and the crown is made up of three drums. Its construction is clearly shown in the illustrations. The tubes connect the drums with the foundation ring. The boiler is provided also with a combustion chamber 44½ in. long, the sides of which are made up of tubes. These tubes follow the inside contour of the shell and extend from the outside drums

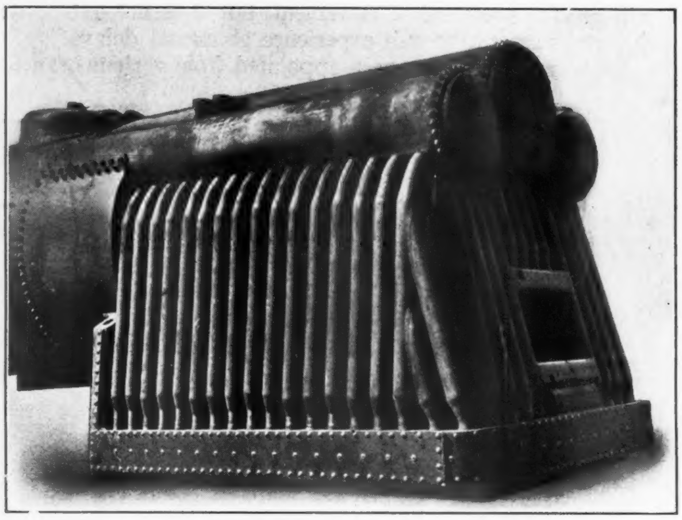
to a circulating chamber, which extends between the tube sheet and the throat. Throughout the construction of the firebox, autogenous welding plays an important part and without it this type of firebox would not have been possible.

The drums are shown by themselves ready for application in one of the photographs. The outside drums are 148¼ in. long, 23 in. outside diameter and ½ in. thick, with the exception of a boss 6 in. wide and 1¾ in. thick, into which the side water-tubes are fitted. These drums were made from a 1¾ in. plate, being planed to ½ in. in thickness, the boss alone remaining the full thickness of the sheet. This boss may be obtained by a less expensive method and was only made in this manner because at the time the firebox was made no other suitable method was available. The front end of these drums is shaped to fit the barrel of the boiler and to make suitable connection with the tube sheet. The two side drums are butt welded for 12¼ in. back from this end to facilitate shaping and for the remainder of their length have a single riveted butt seam with 5½ in. by 7/16 in. inside and outside welt stripes. They are round in the central portion, with the exception of a flattened surface 8½ in. wide, where they are riveted to the middle drum. They are slightly deformed at the back end to receive the back head water-tubes.

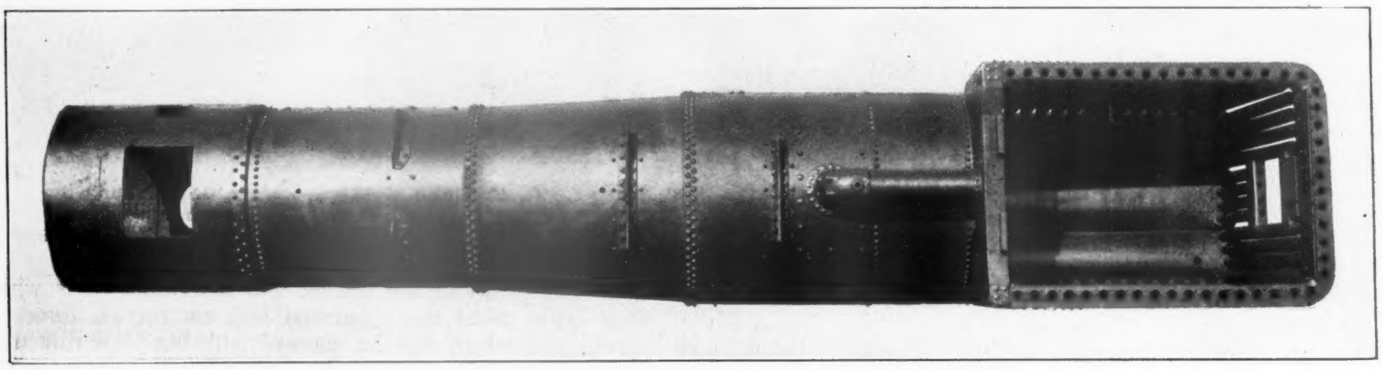
Combustion Chamber for McClellon Firebox

The middle drum is 148¾ in. long, 32 in. outside diameter, and ½ in. thick. It has a flat surface 8½ in. wide on both sides, where it is riveted to the side drums. The back drum head is ⅝ in. thick and is reinforced by a ½ in. liner 16½ in. wide at the openings for the cab turret and injector checkvalve. This drum has a single riveted butt seam similar to the side drums, being welded for a distance of 11½ in. back from the front end. The front ends of all three drums open directly into the barrel of the boiler, which is of the same design as the regular type of locomotive boiler and is equipped with a superheater. The whistle and safety valve openings are located in the middle drum.

The sides of the firebox are made up of fifteen 6-in. tubes, equally spaced for over a distance of 91 in., which gives sufficient space between each tube to allow for expansion. These tubes are expanded and belled into both the foundation ring and the side drums. They are ¼ in. thick and are swaged to 3 15/16 in. at each end. Four of the tubes on each side have two lugs of 2 in. diameter and 1 in. high welded to them to support the lagging and jacket. The corner tubes have two tubes of the same diameter spliced on to them by welding, to give the necessary slope to the back-head. Three 2½ in. holes drilled in these tubes at each splice form the water connection between them. There are eight 5⅜ in. tubes in the back-head—four each side of the firedoor. Four 5 in. tubes connect the upper firedoor header with the middle drum. This header is formed by flattening a 6¾ in. tube and welding it to the long back-head tubes on each side of it. A 3½ in. hole is drilled in each of these tubes to make a water connection between them and the header. The short tubes are rolled into this header through 2½ in. plug holes in the under side of



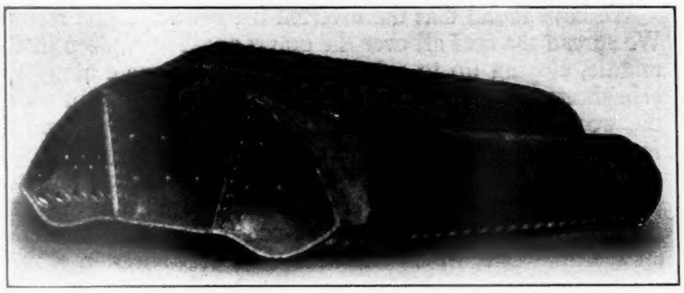
General Arrangement of the McClellon Locomotive Firebox



Bottom View of a Locomotive Boiler Equipped with the McClellon Water-Tube Firebox

the header. The bottom door header is made up of two flattened tubes connected to each other and to the foundation ring by four $2\frac{7}{8}$ in. thimbles. The two sets of thimbles are in line and are rolled into the headers through the plug holes in the bottom of the foundation ring. The top one of the two is connected to the long back-head tubes in the same manner as the upper header, and the lower header is closed at the ends by welding in a plate, simply acting as a filler. Lugs are also provided on the back-head pipes for supporting the lagging, firedoor and other parts.

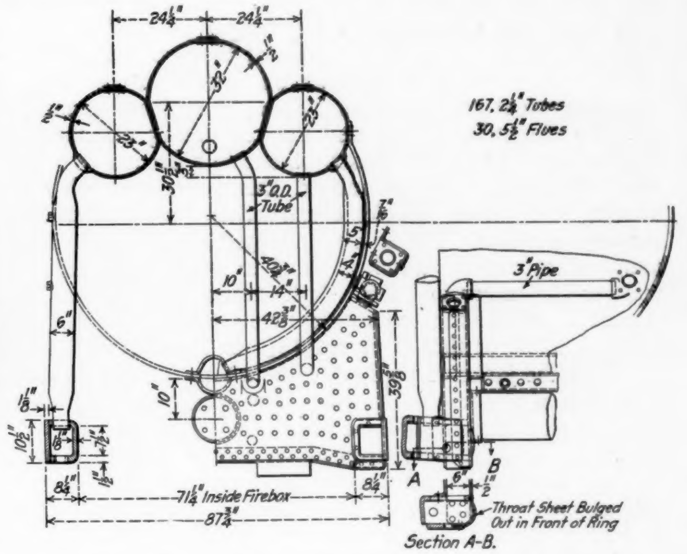
The foundation or mud ring is $107\frac{5}{8}$ in. long and $71\frac{1}{4}$ in. wide on the inside and extends along the sides and back



Steam Drums for the McClellon Firebox

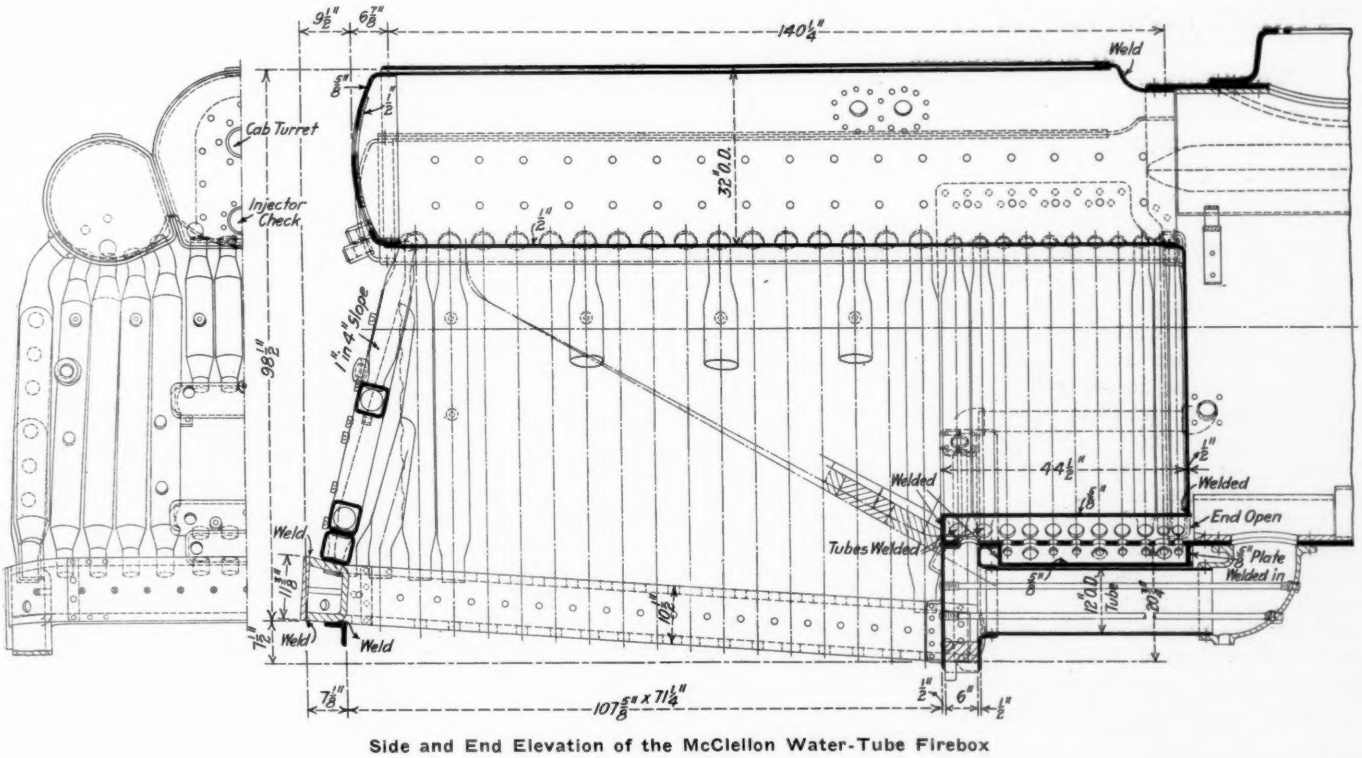
of the firebox, terminating in the throat sheet. It is made up of a rolled plate $1\frac{1}{2}$ in. thick, pressed to the shape of a channel with inside dimensions $7\frac{1}{2}$ in. by 6 in., the legs extending outward. The bottom of this channel or the inside wall of the ring, is planed to $1\frac{1}{8}$ in. thick. A cover plate is attached to the outside legs of the ring by $\frac{7}{8}$ in. screw rivets and it is welded to the channel at the inside corners. This plate is further supported by 1 in. Falls Hollow stay-

at the top and to the cast steel ring which forms the front of the foundation ring, at the bottom. The inside sheet is screw riveted and welded to the inside of the side foundation ring. The sides of the throat are made by flanging the sheets and fastening them by a single riveted lap seam. The throat sheet outside of the foundation ring, is the only



Sections Showing General Details of the McClellon Firebox

member of the firebox that has any staybolts. The passage of the water through this part of the boiler is rapid. Water is fed to it through the circulating chamber into which the combustion chamber tubes pass. In addition to this, there is



Side and End Elevation of the McClellon Water-Tube Firebox

bolts through the center. The water-tubes are expanded and belled into the ring through $3\frac{1}{2}$ in. plug holes in the underside of the ring. The front portion of the ring, to which are riveted the throat sheets, is a steel casting similar to the usual mud ring, to which are bolted the expansion sheets.

The throat sheets are $\frac{1}{2}$ in. thick and have a 6 in. water space. The sheets are flanged and riveted to the boiler shell

a 12-in. feed pipe extending from the middle of the throat forward into the bottom of the last barrel course. The throat also is connected at the top on both sides with the barrel by a 3-in. pipe and to the drums by four 3-in. arch tubes.

The combustion chamber is $44\frac{1}{2}$ in. long and contains from the front to the back, two $2\frac{1}{2}$ in. tubes, eight 4 in. tubes and one 5 in. tube, on each side. These tubes extend between

the side drums at the top and the circulating chamber at the bottom, being curved to the shape of the boiler shell. They are expanded into the drum and the circulating chamber. The circulating chamber consists of a ⅝ in. flanged plate. A second flanged plate, located on the outside of the shell and similar in shape to the one which receives the tubes, is provided with plug holes opposite each tube, through which the roller and bell tools may be used to expand the combustion chamber tubes in the upper flanged plate of the circulating chamber. The bottom ends of the two back tubes on each side are welded in place as, on account of the throat, it is inconvenient to roll them. There is a direct connection between the boiler barrel and the circulating chamber and also between it and the throat. Since this firebox was built, Mr. McClellon has re-arranged this circulating chamber, making it of much simpler construction, but accomplishing the same purpose. The firebox is lagged with a layer of high temperature cement, which is filled in around each tube almost to the center and for a half-inch outside of it. This cement is also reinforced by steel-crete expanded metal and on the outside of this is placed 1½ in. Thermofelt lagging, on which the jacket is applied. The 12-in. feed pipe extending between the last boiler course and the throat is lagged with asbestos cement and jacketed.

These fireboxes were applied to two of an order of 15 Mikado locomotives, weighing a little over 250,000 lb. The firebox heating surface of the ordinary boiler was 229 sq. ft. and of the McClellon boiler 308 sq. ft. There was also a little larger amount of heating surface in the fire tubes in the McClellon boiler and the total square feet of heating surface, including the superheater flues, was 2,827 sq. ft. for the ordinary boiler and 2,937 sq. ft. for the McClellon boiler. The locomotives have not been in service long enough to determine the benefits to be derived from the McClellon firebox.

FIRING ENGINES AT ENGINE HOUSES*

BY A. E. LANGRECK
General Foreman, Terminal Railroad Association, St. Louis, Mo.

For some years we have experimented and tried in various ways to overcome black smoke, when firing up engines, but it may be said at the outset that on account of conditions peculiar to St. Louis, the total elimination of smoke is an impossibility. Methods of firing up locomotives, which have proved successful with non-volatile coal are not applicable here, as we are restricted to bituminous coal. For the purpose of combating the smoke evil our locomotives have been equipped with a smoke eliminating device, but as it is operated by the steam of the locomotive, it cannot be used until steam is generated in the boiler. Its successful operation also depends on the heat of the bed of fire in the firebox, and it does not really become effective until a good fire has been kindled. It is a well-known fact that forced draft wastes fuel and produces smoke.

While firing up does not require a man of high intelligence, it does, however, require a man with some experience. In the larger cities such as St. Louis, where opportunities for employment are many, this class of labor is a mobile one, and for this reason we frequently have to use inexperienced men. Much depends on the way the fuel is placed in the firebox, as well as upon the way it is ignited and the draft used. Experience has shown that the best way to teach these men is by actual demonstration; verbal explanation and instructions generally are not understood by them. In experimenting with various forms of kindling, we found that oil required more attention and blowing and made more smoke than any other kindling material. We have tried kindling by spraying oil on to the fuel through the fire door, by inserting a burner under the grates or through the fire door, and in every case we made smoke. However, if enough oil is used and the coal is thoroughly kindled, a quick fire can be obtained, and the steam will be generated quickly, quicker, perhaps, than with wood, unless a lot of oil is used to kindle the wood. Oil soaked shavings are not quite as objectionable as a smoke producer, probably because they can be made to kindle the coal slower. Perhaps the best results in firing up bituminous coal, where time is no particular object, have been obtained by using dry shavings, properly placed and lit with a handful of greasy waste. By manipulating the blower very good results were obtained. At our terminal, shavings not being readily available, we use old ties, chopped up by means of an air driven chopper.

We have found that the inverted fire gives the best results. We spread the coal all over the grates about 4 in. deep in the middle, sloping up to a height of 12 in. or more along the side sheets, making a kind of a trough in the center, in which the wood is placed lengthwise, the layer of wood extending from the door to the tube sheet. From 1/16 to ⅛ of a cord of wood is used, depending on size of the firebox and the time the engine is wanted. If given sufficient time, a very few sticks of wood will suffice. The wood is ignited by means of oil soaked waste, which has been used previously in wiping engines. If the engine is cold, the house blower is used; where the engine has 40 lb. or more of steam, its own blower is used. The blower is used gently at first, and gradually increased as the coal is ignited. About 15 minutes elapse before it becomes necessary to increase the blower and about 30 minutes before it is put on wide open. On a boiler filled with cold water steam will be generated in about 40 minutes, and 100-lb. pressure is secured in from 70 to 80 minutes. We found that one great factor in smoke elimination in firing up, was to avoid adding coal to the already thoroughly ignited fire. We place enough coal in the box not only to generate the amount of steam required to take the engine out of the house, but also, if possible, to hold the steam pressure until the engine crew takes charge of it and gets it ready for service. Where an engine is fired up from two to four hours before departure from 1,200 to 1,800 lb. of coal is required, depending on the size of the firebox and the boiler. This refers to engines fired up with cold water. Where the boiler has 50 lb. or more pressure a little less coal is necessary. Weather conditions have a great deal to do with the smoke problem. When the weather is murky, or the barometer is low, smoke hangs low with a tendency to spread after leaving the stack.

Just a few words on the cleaning of fires. We clean about 80 fires a day, principally on yard engines, as most of the road engines require that the fire be dumped. Generally it is found harder to clean a fire without making smoke than to build one, where plenty of time is available. Our rule is to clean one-half of the box at a time, shoving the live fire over to the other side, the grates being bared by shaking and the removal of the clinker. A sufficient amount of coal is then placed on the grates and the live fire from the other side is raked over this coal. The other half of the grates is handled in the same manner. Only a blower is used while cleaning, but immediately on closing the fire door the smoke eliminating device is put to work. The time used in cleaning fires varies from 6 to 25 minutes, depending on the size of the firebox, the condition of fire, and the construction of the grates. We find that when road engines come in from long runs it pays to knock out the fire, when neither the condition of the firebox nor repairs would make it necessary. A marked improvement has been made in the elimination of smoke in the engine terminals at St. Louis. All of the engine house foremen in this vicinity have shown an interest in it and we exchange experiences and compare results. By keeping in constant touch with the men that actually do the firing and cleaning we may do better in the future.

* From a paper presented at the convention of the Smoke Prevention Association.

ECONOMICS OF THE SHOP POWER HOUSE

BY V. T. KROPIDLOWSKI

I

A large percentage of the machine tools in locomotive repair shops are now driven by electricity, and electric drive is almost entirely used whenever new shops are built. With the development of this situation, public utility companies have begun to see in it a good opportunity for building up a power load capable of utilizing the extra daytime capacity required to meet the night lighting load, and are becoming active in bidding for this business.

One of the claims most frequently made by the central station representatives is that the power can be produced much cheaper in the central stations than it can possibly be produced in the shop power plant. Although it is true in many instances that the private plant is extravagant, due to local conditions sometimes unavoidable, there are many instances in which the private plant is producing energy as economically as it could be supplied by the central station. When taking into consideration the utilization of exhaust steam for heating, a well designed and managed shop plant is capable of producing energy cheaper than it can be purchased from any outside source.

It is the purpose of these articles to consider the merits of the shop power plant as opposed to the central station, as a source of power supply for use in railroad repair shops, on the basis of the available facts. It is not the intention to discuss the question of supplying energy for railroad electrification. Whether a railroad should possess its own plant for this purpose, or purchase its energy from a central station, is a problem involving entirely different elements.

The subject will be treated in three articles. The first will be a general discussion of shop electrification and the factors entering into the cost of power; in the second, these factors will be discussed more in detail and the data on which the assertions in the first are based will be presented. The third will be devoted to an analysis of the cost of construction and the cost of operating an actual shop plant. The cost of power produced by this plant will be compared with the price at which this power could be obtained from a public service plant.

ADVANTAGES OF ELECTRIC DRIVE

Opinions as to the advantages which the electric drive has over the old system of line shaft and belt drive may be divided roughly into two classes: those which are held by the central station representatives and those expressed by disinterested engineers. To facilitate the comparison of these two sets of claims, they have been tabulated below.

ADVANTAGES CLAIMED FOR ELECTRIC DRIVE

Central Station Solicitor's Claims	Disinterested Engineer's Views
Advantages	*Advantages*
Reduction of losses from shafting friction, belt racing and belt troubles.	Flexibility; ability to add and relocate machinery.
More flexibility and better machinery arrangement.	Better light due to absence of belting.
More reliable power and steadier speed.	Greater convenience and cleanliness.
Better light, through absence of belting.	Saving of overhead space.
Cheaper insurance due to separated power house.	
Small power house and foundations.	
Saving of shop space.	
More accurate knowledge of the power developed.	
Easier to find machine troubles by use of electric instruments.	
Ability to stop and start machine quickly.	
Disadvantages	*Disadvantages*
Greater first cost of installation.	Greater first cost of installation.
Cost of operation.	Cost of operation.

Transmission Losses.—It will be noted that the disinterested engineer claims no advantage for the electric drive in the reduction of transmission losses by the elimination of line shaft friction and belt slip. While this is one of the arguments most frequently used in favor of electric drive, the saving claimed has not been developed in practice. The losses due to shafting friction and belt-slip do not exceed 20 per cent of the total power required, except in a few lines of manufacture, and generally are nearer 10 per cent.

On the other hand, electric line losses are seldom less than five per cent. Placing the average working efficiency of the motors at 85 per cent, it can readily be seen that the power output of the motors is but slightly above 80 per cent of the electric power required at the switchboard.

This is a conservative statement of the situation. The writer knows of shop installations using line shaft and belt transmission, where the machinery, shafting, belting, etc., have been laid out properly and are properly maintained, in which the loss from shafting and belt friction does not exceed 12 per cent. In another case a large amount of heavy shafting and countershafting was removed and the electric drive substituted, but the actual friction loss was not diminished. In order to keep down the first cost of the installation and because of the low head room available, the motors were of the highest speed obtainable, making the ratio of driving and driven pulley diameters too great for economical transmission. Owing to the exceedingly small motor pulleys and the short centers, heavy belt tensions were required, deflecting the shafting and consequently producing heavy bearing pressure and high friction losses throughout the installation.

Reliability of Electric Power.—It is questionable whether electric power is more reliable than the old system of line shafting and belt transmission. The writer's experience, as well as that of others, indicates that in the case of a shop power plant, where the electric power transmission and distributing system is comparatively simple, the two forms of transmission are about equally reliable. Where there are long, high tension transmission lines and a network of distributing systems, as in the case of the public service power plants, it seems reasonable that the chances of interruption due to such causes as severe storms, electrolytic troubles, operating troubles, etc., are increased.

Minor Advantages.—The other claims made by the solicitors which are not upheld by the disinterested engineer may all be grouped under the one claim of "greater convenience and cleanliness."

An electric plant, to require a smaller power house and machinery foundations, must be equipped with steam turbines, otherwise the electric generator demands practically the same size engine as would be required to drive the shop directly through belt and line shaft. On the contrary the engine room must be larger to accommodate the generator and switchboard. In case the power is purchased, of course, the powerhouse may be somewhat smaller, but not materially so, for the switchboard, transformers, motors for driving air compressors, and other auxiliaries will take up practically the space required for the stationary engines.

There is no propriety in the claim that it is easier to find machine trouble with the electric drive. There are no troubles, aside from those due to the electrical apparatus, which can not be detected and located with the naked eye or with one of the other senses.

Steam Transmission Losses.—There is one notable gain that can be derived from the installation of electric power which evidently has been overlooked. It is the elimination of condensation losses in steam lines in the many instances where the steam must be conveyed for considerable distances to small steam engines scattered about the plant. Such steam engines could be replaced by electric motors and transmission losses reduced at least 5 per cent. It is not uncommon to suffer a loss of 10 per cent of the total power delivered at the point of supply where the steam is distributed to several points of consumption through open air or under-

ground pipe lines, say within a radius of about 700 or 800 ft. Considering the mechanical efficiency of a small steam engine to be about the same as that of an electric motor—which is extremely improbable as small steam engines are known to be very extravagant and not at all comparable with electric motors of equal size—and allowing a loss of 5 per cent for the electric transmission line, a saving of 5 per cent would be realized in favor of electricity. In many cases an actual saving as high as 10 to 15 per cent might be realized.

PURCHASED POWER

The central station solicitor naturally charges against the isolated plant everything that he possibly can. He charges the plant with rent, part of the manager's salary and subjects it to quick depreciation, making it put aside from 1/10 to 1/20 of its cost each year for renewal, while continuing to charge interest on the full investment. He does not concede that the use of the exhaust steam from the engines of the shop plant has any material bearing upon the cost of the power. If reminded that the exhaust steam is needed for heating the shop, etc., he tries to prove that the back pressure of the heating system will neutralize any saving thus effected.

While most of the above charges should enter into the cost of power from the shop plant as well as the central station, they are exaggerated when applied to the accounting of an isolated plant. Let us then analyze them.

Fixed Charges Compared.—The shop plant is subject to the same charges as is the central station, with the exception of the expenses of soliciting business, maintaining meters and taking meter readings, the clerical expense of rendering bills and keeping accounts and the heavy cost of distributing lines.

The central station necessarily must have the best and the most expensive machinery in its plant, as the service to be rendered is more exacting. The machinery is harder worked, and owing to the keen competition and the continual development of more economical and improved machinery, it is scrapped earlier. As a consequence the amount to be set aside annually as a sinking fund reserve to cover physical depreciation and obsolescence, must be much greater than for the isolated plant.

According to the reports of the public service commission of an Eastern State, the actual operating expense of a certain large central station forms only 26½ per cent of the total cost of production, the remaining 73½ per cent being made up of overhead and distribution charges. Furthermore, this same company is capitalized at over $400 per kilowatt capacity. Of course this is an abnormal case of capitalization, but such concerns are capitalized at the rate of $250 per kilowatt and higher, whereas an up-to-date shop plant can be installed complete for $75 to $100 per kilowatt.

Exhaust Steam Heating and Back Pressure.—The assertion that the back pressure imposed on the engine by the heating system neutralizes the gain derived from the utilization of the exhaust is not justified. Any fair minded observer acquainted with steam engineering practice will concede that a plant such as a railroad repair shop, requiring a boiler plant for heating and other purposes, can put in an engine, run it as a reducing valve between the high pressure boilers and the heating system and make what electrical energy is needed more cheaply than it can be produced and delivered at a profit by a central station.

The capital invested for this purpose of course must pay a dividend, if the company is on a dividend paying basis. Since the heating plant, and the same thing is true of the power plant as a whole, is not a producing agency, this dividend must be met by the revenue-producing departments. For example, if a company paying an average of seven per cent on the capital invested can obtain heat, light and power from an outside source at a price equal to the operating cost for production in the shop plant, plus depreciation, interest, taxes, etc., plus less than seven per cent on the money which would have to be invested to equip the shop plant, then it would be economy to buy heat and electric power as some portion of the income from the revenue bearing departments which would be required to pay the seven per cent on the capital invested in this non-revenue earning department would be available for other purposes. Otherwise the shop plant is a good investment.

Electric Power Contracts.—Power contracts are usually of a most peculiar construction. The purpose of the extraordinary wording of these instruments is to provide for a scale of prices differing for various conditions of power service, all into one agreement. The actual prices in most of these contracts depend upon the amount of power used, allowances for discounts, etc. In some of them the price is based upon the maximum demand, a fixed charge per horsepower of connected load, or on a sliding scale. Where the price of power is fixed on the basis of maximum demand, either a fixed charge is made for each kilowatt of maximum demand, and the actual kilowatt-hours of power consumption is charged for at a fixed rate, a sliding scale of rates may be used, the rate employed depending upon the amount of the maximum power demand.

The actual operation of the maximum demand clause varies considerably, depending on the time element provision. Some contracts are based on a maximum demand for a time limit of half an hour, others for 15 min., and others for the extremely short period of two minutes. The last figure may mean a serious injustice to the purchaser. The limiting period should be at least 10 min., preferably half an hour.

The fixed price, or, as it is sometimes termed, the readiness-to-serve charge, may also be based on the horsepower of motors installed. This method, in some plants, works a hardship upon the consumer, while in others it may be a fair one. Take a plant, for instance, where there is a very large connected load, but only a small portion of it is being used at any one time. In this case the readiness-to-serve charge may often amount to more than the total power bill for the month. In another shop, where at certain months of the year practically the whole connected motor horsepower is in demand, this method is a fair one.

The power companies employing this system uphold it on the ground that it is only fair that they earn interest on the money invested in the plant equipment, which they must have in readiness to furnish the full connected power whenever the customer wills to use it. But it often burdens the individual user with many times over his fair proportion of the total amount required.

There remains but one solution to the problem of securing the most economical power, and that is to determine the comparative cost of purchasing it outside and generating it in the shop. In determining what is the cost of power generated in the shop plant, care should be taken not to overlook all legitimate charges to the power account. If the addition of power generating equipment to the plant necessary for heating and other auxiliary purposes, requires new buildings, the additional investment only should be charged against the power. If more or higher paid men must be employed, this additional expenditure should be also charged. If the manager gets more salary because he has to supervise the generating station, then the additional expense thus incurred should go to the power account. The cost of the power should also include an amortization charge sufficient to replace the capital invested in the equipment at the end of its probable life, interest at the rate which the money could earn and such taxes and insurance as the additional investment requires. If, with all these charges, the investment promises a profit when credited with the cost of power at the central station rate, it is justified.

Car Department

AIR BRAKE LEVER COMPUTATIONS*

BY LEWIS K. SILLCOX
Mechanical Engineer, Illinois Central

The average man on the line has not the time to figure air brake leverage and he is often not conversant enough with mathematical computations necessary to arrive at the proper location of holes for drilling the various levers. The following formulas in connection with Figs. 1 and 2 give an ab-

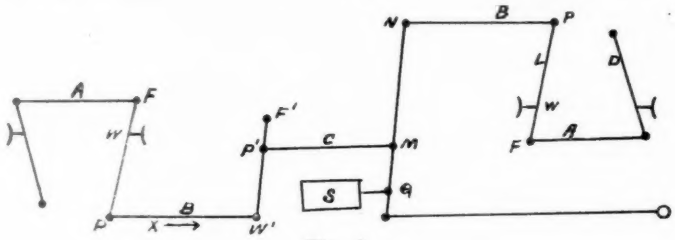


Fig. 1

solutely accurate method for this work together with methods for checking the levers applied to any freight car. Referring to Fig. 1, the letters shown indicate the following parts:

A = Bottom connection.
B = Top connection.
C = Center connection.
D = Dead lever.
L = Live lever.
S = Force from brake cylinder.

In designing the rigging make the live and dead levers the same proportion and use any of the following proportions: 3 to 1, 3½ to 1 or 2½ to 1. The design of the car will determine the length of the levers. The top and

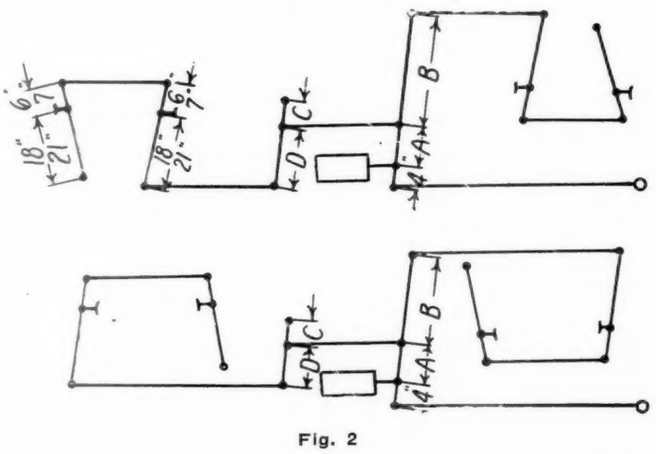


Fig. 2

center connections should pull as nearly parallel as possible. The total braking power should equal 60 per cent of the light weight of the car. Assuming Z = the light weight of the car, we have the following:

(1) Power required on top connection $= X = \dfrac{Z \times .60 \times WF}{4 \times PF}$

(2) Proportions of cylinder lever $= MN = \dfrac{S \times QN}{X + S}$

(3) Proportions of floating lever $= W_1P_1 = \dfrac{S \times W_1F_1}{X + S}$

(4) Instead of (3) this proportion can be used: $\dfrac{QN}{QM} = \dfrac{W_1F_1}{P_1F_1}$

(5) Use to check hand brake end: $\dfrac{S \times QM \times PF}{MN \times WF} = \dfrac{A \times .60}{4} = W$

(6) Use to check end opposite hand brake:
$$\frac{S \times QN \times P_1F_1 \times PF}{MN \times W_1F_1 \times WF} = \frac{A \times .60}{4} = W$$

Example: Box car having a light weight of 40,000 lb. with truck levers drilled for holes spaced 6 in. and 18 in. apart, cylinder lever distance Q to N (Fig. 1) or A + B (Fig. 2) to equal 34 in., floating lever W_1 to F_1 (Fig. 1) or D + C (Fig. 2) to equal 17 in.

Total braking power = .60 × 40,000 = 24,000 lb.

1. Power required on top connection $= X = \dfrac{A \times .60 \times WF}{4 \times PF}$ or $\dfrac{40{,}000 \times .60 \times 6}{4 \times 24} = 1{,}500$ lb.

2. Proportions of cylinder lever $= MN = \dfrac{S \times QN}{X + S}$ or $\dfrac{4{,}000 \times 34}{1{,}500 \times 4{,}000} = 24.74$ in.

3. Proportions of floating lever $= W_1P_1 = \dfrac{S \times W_1F_1}{X + S}$ or $\dfrac{4{,}000 \times 17}{1{,}500 + 4{,}000} = 12.37$

4. In place of following method (3) the following proportion may be used:
$$\frac{QN}{QM} = \frac{W_1F_1}{P_1F_1}$$
$QM = QN - N = 34 - 24.74 = 9.26$
$P_1F_1 = W_1F_1 - W_1P_1 = 17 - 12.37 = 4.63$
Substituting in the above equation we have
$$\frac{34}{9.26} = \frac{17}{4.63}$$
or
$$157.42 = 157.42$$
Which shows that the calculations are correct.

5. $\dfrac{S \times QM \times PF}{MN \times WF} = \dfrac{A \times .60}{4} = W$ or force applied to each brake beam
$$\frac{4{,}000 \times 9.26 \times 24}{24.74 \times 6} = \frac{4{,}000 \times .60}{4} = 6{,}000 \text{ lb.}$$

Air Brake Arrangement.—Locate the cylinder so that the cross tie will not interfere with the removal of the piston,

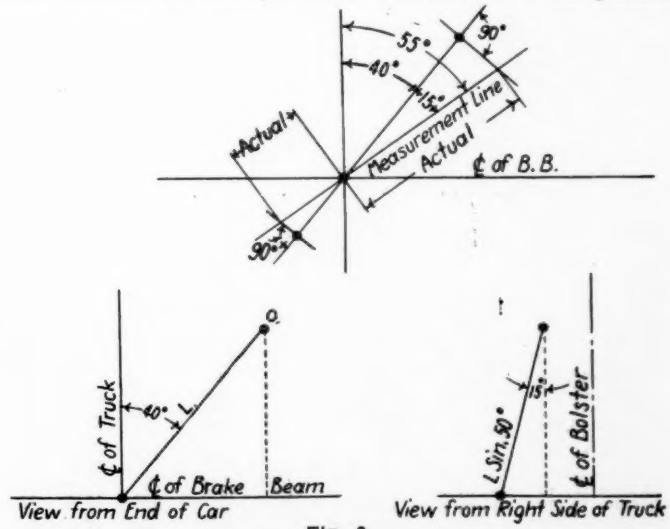


Fig. 3

which requires a minimum distance of 13 in. Check the clearance between the push rod and truss rod strut. See

*From a paper presented to the Car Foremen's Association of Chicago.

that the levers do not interfere with the cross ties or truss rod struts when the brakes are applied, figuring a travel of the live lever of about 15 in. maximum. Minimum push rod travel with new shoes should be 4 in., the maximum with shoes removed, should be 12 in. Check the live lever guide and see that it will allow plenty of travel for the lever, and see that it does not interfere with the application of the top connection.

Truck levers should stand at an angle of 40 deg. from the vertical and should incline towards the bolster at an angle of 15 deg. when the brakes are released. To find the actual length of the lever the following practice will be observed: Lay out on the end elevation the center line of the lever at an angle of 40 deg. from the vertical, and intersect the center line of the car at the center of the brake beam. The measurement line is then laid at an angle of 55 deg. from the vertical, or 15 deg. more than the lever, intersecting at the same point. Measurements are made on this line and projected to the lever at right angles to it. See Fig. 3.

The following is a method of obtaining the height of the dead lever above the center line of the brake beam when the length of the lever is assumed:

The line drawn from point O to the center line of brake beam $= L$ Sin. 50°.

$$\text{Height} = L \text{ Sin. } 50° \times \text{Cos. } 15°.$$

The following table can be used for locating the holes in the cylinder and floating levers for cars having a truck

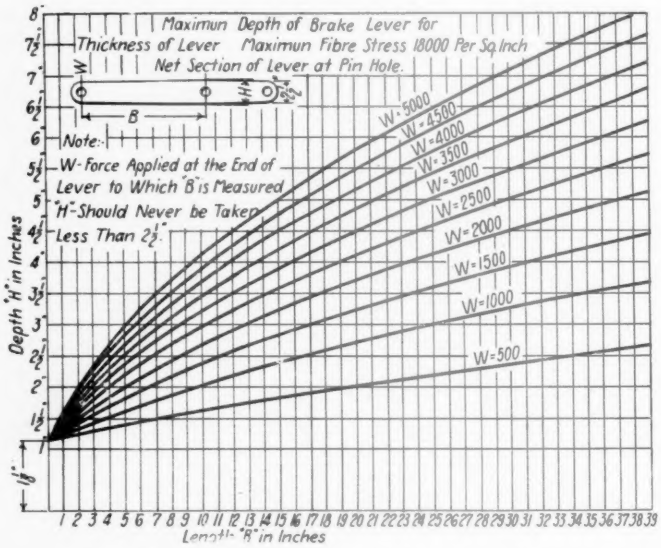


Fig. 4—Proper Size of Brake Levers

lever ratio of 3 to 1 (that is, 6 in. to 18 in. or 7 in. to 21 in. as shown in Fig. 2) and a braking power based on 60 per cent of the light weight of the car:

Light weight of car	Cylinder lever size in.	Floating lever size in.	Holes for cylinder lever A in.	Holes for cylinder lever B in.	Holes for floating lever C in.	Holes for floating lever D in.	Brake cylinder diameter in.
20,000—21,999	3¼ by 1	2½ by 1	7⅞	26⅛	3 13/16	13 3/16	8
22,000—23,999	3¼ by 1	2½ by 1	8½	25½	4¼	12¾	8
24,000—25,999	3¼ by 1	2½ by 1	9	25	4½	12½	8
26,000—27,999	3¼ by 1	2½ by 1	9 9/16	24 7/16	4¾	12¼	8
28,000—29,999	3¾ by 1	2¾ by 1	10 1/16	23 15/16	5	12	8
30,000—31,999	3¾ by 1	2¾ by 1	10⅝	23⅜	5 5/16	11 11/16	8
32,000—33,999	3¾ by 1	2¾ by 1	11	23	5½	11½	8
34,000—35,999	3¾ by 1	2¾ by 1	11½	22½	5¾	11¼	8
36,000—37,999	3¾ by 1	2¾ by 1	11 15/16	22 1/16	6	11	8
38,000—39,999	3¾ by 1	2¾ by 1	8⅞	25⅛	4 7/16	12 9/16	10
40,000—41,999	3¾ by 1	2¾ by 1	9¼	24¾	4⅝	12⅜	10
42,000—43,999	4 by 1	3 by 1	9⅝	24⅜	4 13/16	12 3/16	10
44,000—45,999	4 by 1	3 by 1	9 15/16	24 1/16	5	12	10
46,000—47,999	4 by 1	3 by 1	10¼	23¾	5⅛	11⅞	10
48,000—49,999	4 by 1	3 by 1	10⅝	23⅜	5 5/16	11 11/16	10
50,000—51,999	4 by 1	3 by 1	11	23	5½	11½	10
52,000—53,999	4 by 1	3 by 1	11¼	22¾	5⅝	11⅜	10
54,000—55,999	4½ by 1	3¼ by 1	11½	22½	5¾	11¼	10
56,000—57,999	4½ by 1	3¼ by 1	11¾	22¼	5⅞	11⅛	10
58,000—59,999	4½ by 1	3¼ by 1	12	22	6	11	10
60,000—61,999	4½ by 1	3¼ by 1	12¼	21¾	6⅛	10⅞	10

The proper size of brake levers is shown in Fig. 4.

CO-OPERATION OF ALL ROADS NEEDED TO REDUCE HOT BOXES*

BY JOSEPH DALZELL
Foreman Car Inspector, Pennsylvania Railroad, Pitcairn, Pa.

Hot boxes on freight cars, what really causes them, and how they may be avoided, are vital questions. We all are agreed that they are a source of great annoyance and expense in taking cars temporarily out of the service and in holding up traffic, and each one of us should be a party to their elimination. If we insist on following old time methods of lubrication these hot boxes, like Hamlet's ghost, will always come back to plague us. If we are to avoid hot boxes we must get after them in a systematic manner, and when the trouble is reduced we must not relax our efforts, as hot boxes are persistent and must be given persistent treatment.

First, we must have a sufficient number of car oilers—men who have had some experience at car oiling and who will take a personal interest in their work. A competent car inspector should have charge of these men and instruct them in their duties, accompanying them on the trains, and seeing that the work is properly performed.

Car oiling, as carried out by the rules of the Pennsylvania Railroad, may be divided into three parts: Preparation of sponging, packing of journal boxes, and examination of journal boxes.

Preparation of sponging.—The waste must be separated into small pieces and not rolled in bunches, and must not be cut. It must be submerged in car oil for 48 hours. Before using it must be placed on a rack and the surplus oil drained off until it contains approximately three pounds of oil to one pound of waste. It is then ready for use.

Packing of journal boxes.—The car oilers should go over the trains, examining each box carefully to see that a thorough back wall of packing has been set up to assist the dust-guard to retain the oil and keep out dirt. The sponging, if disarranged, should be set up to the centre line of journal—not too tight—and if the packing is dry a little oil should be used, placed well back to the rear side of the journal according to the direction the car is to be moved. The packing must be flush with the end of the journal and must not be connected with the plug in the front end of the journal and inside face of box. Cars given this attention should be marked, with chalk, with the month and day directly over each bolster, thus 9-26, as a guide to other car oilers that the boxes have been given attention on that date, and do not necessarily require attention for a period of 10 days.

The inspector having charge of these men should see that no cars are marked in this manner that have not been given the proper attention, as it is our experience that it is not the journals that have been given attention that cause trouble, but the journals that have not been attended to, or those carelessly marked. It is understood that this inspector is held responsible for the work of his car oilers and the economical use of oil and sponging.

Examination of journal boxes.—Car oiling or setting up of the sponging to the journals does not, however, remedy all of the trouble. There are other defects that cause boxes to run hot, no matter how well they may be lubricated, such as worn out or cracked bearings, second-hand bearings applied to new journals, bearings not bearing equally on journals, or rough or cut journals. It is therefore necessary to jack up all hot journals to determine the exact cause of the trouble, and those that cannot be remedied by the application of new journal bearings must be sent to the repair shop for necessary attention.

With the proper care and supervision all of these defects can be remedied and hot boxes very materially reduced, if not altogether eliminated, but this practice must be followed up, not by one road, but by the concerted action of all.

*Entered in Hot Box Competition.

RESISTANCE OF PASSENGER CARS*

Relation of Resistance to Speed for Cars of Various Weights Found by Dynamometer Tests

BY E. C. SCHMIDT† and H. H. DUNN‡

DYNAMOMETER car tests to determine the resistance of heavy passenger trains have recently been made by the department of railway engineering of the University of Illinois on the tracks of the Illinois Central between Champaign, Ill., and Centralia. The tests were made in regular through passenger service. It was found that the specific resistance is materially affected by the weight of the cars composing the train, and that it decreases as the average weight of the cars increases.

The Trains Tested.—The trains experimented upon—18 in number—were all passenger trains, which varied in total weight from 535 to 727 tons. The number of cars varied from eight to twelve. The train make-up was not uniform and is shown for each train in the table. The average gross weight per car in the various trains ranged from 48.7 to 71.1 tons. In 13 of the 18 trains the dynamometer car was coupled with its measuring drawbar toward the rear, and in these cases its own resistance is excluded from the test car records; its weight is consequently likewise excluded from the train weights listed in the table. In the five remaining trains, on the other hand, the resistance of the dynamometer car itself is included in the records and its weight is therefore included in the train weight. Since the test car weighs only 29 tons, the normal average car weight is somewhat lowered in these five instances. All but 32 of the 187 cars included in the 18 trains had six-wheeled trucks. Other data defining the train make-up are given in the table.

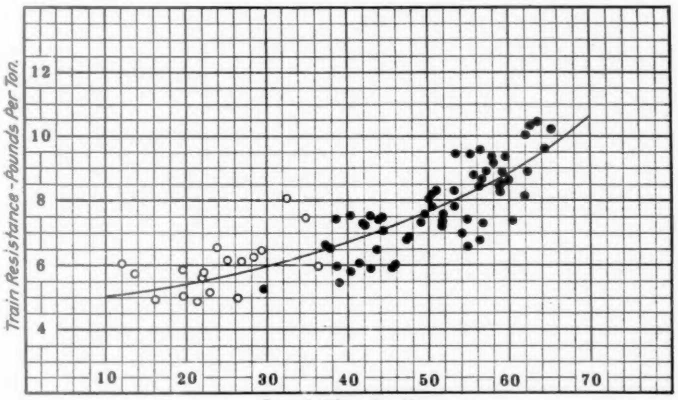


Fig. 1—Relation Between Resistance and Speed for Test 44B

The tests were made on trains running both North and South. The northbound trains had a scheduled running speed of 47.5 m. p. h. and the southbound trains had a scheduled running speed of 43.7 m. p. h.

Track and the Weather Conditions.—The roadbed on which the tests were made was in good condition and the drainage, in general, was excellent. Except on a few short stretches through station grounds, where cinders and screenings are used for ballast, both tracks are ballasted with broken limestone. The cross-ties, 6 in. by 6 in. by 8 ft., are spaced about 20 in. between centers and are of treated red oak, treated soft wood or untreated white oak. Sixty-one miles of the southbound track are laid with 85-lb. rail of American Society of Civil Engineers section, while the remaining 63.5 miles are laid with 90-lb. rail of American Railway Association section. Practically all of the northbound track is laid with 85-lb. rail of American Society of Civil Engineers section. All rails are laid with broken joints supported on two ties. During eight months of the year there is employed in maintaining this portion of the road, a force of men averaging one man per mile of track. During the remaining four months this force is reduced to one man for each two miles.

The tests were all made on fair summer days, the air temperature which prevailed during the tests varying from 69 degrees to 93 degrees Fahrenheit. The wind velocity varied up to 25 m. h. p.

Test Methods.—The apparatus within the dynamometer car used produces continuous graphical records of the gross resistance of the train, the speed, time, brake cylinder pressure, wind direction and wind velocity. The net weights of all cars were obtained from the records of the Illinois Central and the Pullman Company. To determine the car loads, passengers were counted and allowed for at 140 lb. each; the weights of baggage and mail were estimated by personal inspection and count of the contents of each car; the weight of express was determined by reference to the bills, supplemented by inspection and estimate. The maximum error in the gross train load itself caused by the processes described is less than 1 per cent.

TRAINS USED FOR RESISTANCE TESTS

Test Number	Average Approximate Wind Velocity, Miles Per Hr.	Gross Train Wt. Tons	Cars in Train	No. of Cars Having Three Axles Per Truck	Kind of Cars: Test Car	Baggage and Express	Mail	Coaches	Pullmans	Diner	Special
44A	....	604.5	11	9	..	6	2	2	1	..	..
44B	....	570.0	11	9	..	6	2	2	1	..	..
46A	20.0	615.48	11	9	..	4	4	2	1	..	..
46B	15.0	551.32	10	8	..	3	4	2	1	..	..
47	10.0	727.0	11	10	1	1	1	3	4	1	..
48A	....	538.5	11	9	..	5	2	2	1	..	1
48B	....	562.0	11	8	..	6	2	2	1	..	..
49A	20.0	588.2	9	8	1	1	1	2	3	1	..
49B	20.0	634.9	10	8	1	1	1	3	3	1	..
50A	25.0	601.6	12	9	1	6	2	2	1	..	..
50B	25.0	535.2	11	8	1	5	2	2	1	..	..
51A	20.0	618.01	9	8	..	1	1	3	3	1	..
51B	20.0	549.02	8	7	..	1	1	2	3	1	..
52A	20.0	570.1	11	9	..	6	2	2	1	..	..
52B	15.0	540.0	11	9	..	5	2	2	1	..	1
53A	15.0	708.3	10	9	..	1	1	3	4	1	..
53B	15.0	639.92	9	9	..	1	1	2	4	1	..
54	20.0	606.23	11	9	..	6	2	2	1	..	..

All resistance values here presented have been corrected for grade and for acceleration, and they denote, therefore, the resistance of the train when running at uniform speed on level track. The data do not permit the resistance due to wind to be differentiated and this element of resistance is consequently included in the values presented. Unless otherwise stated, these resistance values are expressed in terms of pounds per ton of gross train weight.

Test Results.—The immediate purpose of the tests was to define for each train the relation between net resistance and speed. On the dynamometer car records for each train there were accordingly chosen a number of points or sections corresponding to as great a variety of speeds as the data

* Abstract of a paper published in Bulletin 194 of the American Railway Engineering Association.
† Professor of Railway Engineering, University of Illinois.
‡ Assistant in Railway Engineering, Engineering Experiment Station, University of Illinois.

presented. At each section the net resistance was calculated and the calculated value with its corresponding speed was plotted on a diagram such as Fig. 1. The black dots define average value of resistance during the passage of the train over several hundred feet of track at a uniform speed and the circles define instantaneous resistance values as the train passes a particular point on the road. In this manner a similar curve has been produced for each of the eighteen trains tested. All eighteen of these curves are brought together in Fig. 2.

An inspection of Fig 2 shows that at 20 m. p. h., the values of resistance vary from 4.1 to 6.3 lb. per ton, and at 70 m. p. h. the values of resistance range from 8.0 to 11.4 lb. per ton. This variation is chiefly due to the differences in the average weights of the cars composing the different trains. Those trains composed of relatively light cars have the higher resistance (expressed in pounds per ton), whereas trains of

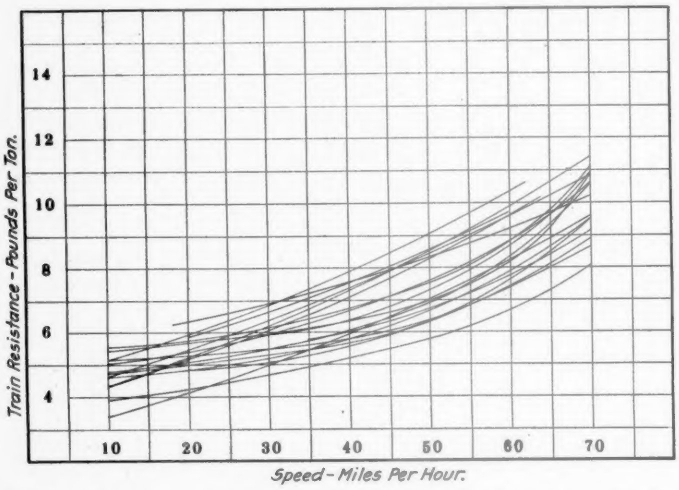


Fig. 2—Relation Between Resistance and Speed for the 18 Trains Tested.

heavy cars have a low specific resistance. This fact is better established by the process described below.

If in Fig. 2 at the point corresponding to 20 m. p. h. a perpendicular is erected, it will cut the curves in eighteen points, each of which pertains to a particular train and defines for that train the average value of resistance at a speed of 20 m. p. h. If each of these resistance values are plotted

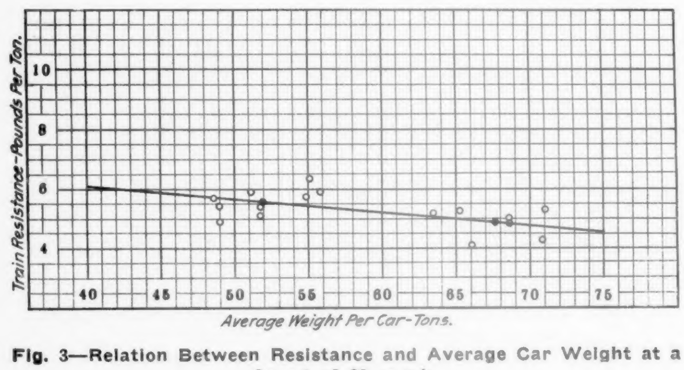


Fig. 3—Relation Between Resistance and Average Car Weight at a Speed of 20 m.p.h.

with respect to the average car weight of the train to which it pertains, the diagram shown in Fig. 3 is obtained. It is obvious that as the car weight increases, the specific resistance decreases. The average rate of this decrease is shown by the straight line. By a similar process, six other such straight lines have been determined defining this relation at speeds of 10, 30, 40, 50, 60 and 70 m. p. h. These six lines, together with those from Fig. 3, are all brought together in Fig. 4, which shows the average relation between resistance and car weight for each of seven different speeds. This figure, however, presents the relations in unusual form and Fig. 5 has been drawn from Fig. 4 to show a corresponding group of resistance-speed curves.

The relation between the two figures will be made clear by explaining the derivation of the upper curve in Fig. 5—

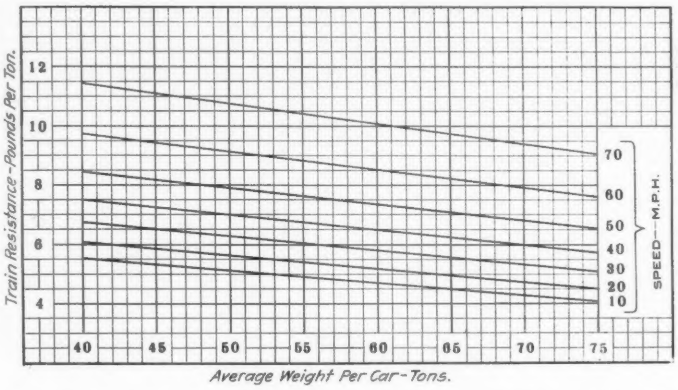


Fig. 4—Relation Between Resistance and Average Car Weight at Various Speeds

the one applying to a car weight of 40 tons. In Fig. 4 the ordinate corresponding to an average car weight of 40 tons cuts the seven lines there drawn at seven points at which the mean resistance values are 5.5, 6.7, 7.5, 8.5, 9.7 and 11.5 lb. per ton, corresponding to speeds of 10, 20, 30, 40, 50, 60 and 70 m. p. h., respectively. These values are the co-ordinates of seven points on a resistance-speed curve applying to a

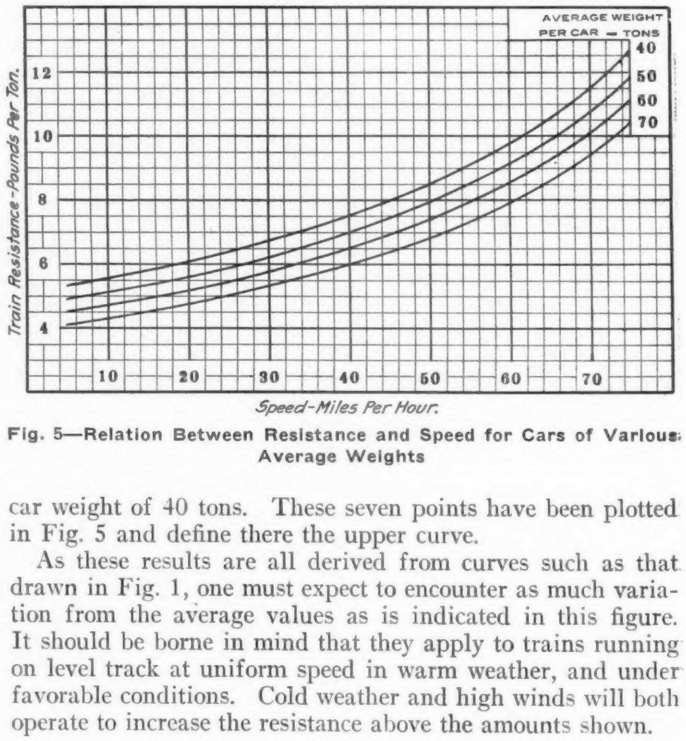


Fig. 5—Relation Between Resistance and Speed for Cars of Various Average Weights

car weight of 40 tons. These seven points have been plotted in Fig. 5 and define there the upper curve.

As these results are all derived from curves such as that drawn in Fig. 1, one must expect to encounter as much variation from the average values as is indicated in this figure. It should be borne in mind that they apply to trains running on level track at uniform speed in warm weather, and under favorable conditions. Cold weather and high winds will both operate to increase the resistance above the amounts shown.

Oxy-Acetylene Welding.—The speed at which work can be welded by the oxy-acetylene process varies with its nature. In the following table is given the speed per hour on iron plates:

Thickness of plate	3/64 in.	1/8 in.	3/8 in.	1/2 in.
Length welded per hour	30 ft.	14 ft.	6 ft.	4 ft.

These figures were obtained when the plates on which the welding was done were cold. By preheating the parts near to the weld in 1/4 in. plates and upwards, the time and cost can be reduced.—*Institution of Mechanical Engineers.*

PREVENT HOT BOXES BY EDUCATION*

BY W. S. CLARK
Car Foreman, New York Central, East Syracuse, N. Y.

The greater number of hot boxes are due to lack of proper attention by what are termed "car oilers," but who should be called "journal box caretakers," as no free oil should be used in properly taking care of journal boxes. When inspecting cars you will find some journal boxes overloaded with packing, while others do not have sufficient. Both of these conditions make hot boxes. Brasses worn thin are in many cases not removed until they have started trouble and you have hot boxes and cut journals.

To eliminate these conditions and have perfect running cars it is necessary first to see that the journal box packing is mixed and properly proportioned with waste and oil. This requires mixing tanks and a "prepared" packing tank, the sizes of tanks to be in accordance with shop or yard capacity. These tanks should have drainage racks in the bottom and be equipped with 1¼-inch faucets. The waste should be pulled apart, placed in the mixing tank and then submerged in oil, and allowed to stand for 24 hours. An exact record should be kept of the number of pounds of waste and the number of gallons of oil used. Then draw off the oil, leaving four pints of oil to one pound of waste. Transfer this packing into the "prepared" tank. Twice daily draw off the oil that has settled in the bottom of the tank and pour it over the top of the prepared packing. By so doing you always have a mixture which is standard.

The treating of journal boxes has become a science, and is not an "everyman's" job. Employees may be educated to become scientific at their work by proper supervision. They should be furnished with books of instruction on the lubrication and care of journal boxes.

Journal boxes which are to be repacked should be handled in the following manner: A uniform size roll, say 2 in. in diameter by 10 in. long, should be made of dry waste and be submerged in oil. Place this roll in the back of the journal box. Then pack the box under the collar of the journal at the front. Force back with the packing iron until it is within one-fourth of an inch of the center line of the journal, making sure that all packing is back of the collar of the journal. Then place a piece of packing by hand in the front of the box, not spudded and having no strings of waste hanging out of the box. Do not pack the box too tight.

The foreman in charge should pack a few boxes for each man assigned to this work, and explain to him why the roll is placed in the back and the piece in the front of the box and why these three operations are necessary. He should then watch the man repack 10 or 12 boxes and correct him each time he makes a mistake, never snatching the packing iron from his hand, but demonstrating to him in a mild manner. When a man has gone over a few boxes you can determine whether he will make good or not, for not every man is fitted to do this work.

In caring for cars in trains in the yard, if the packing needs rearranging sufficient waste should be pulled out of the box and then "spudded" back. Be sure to keep the packing within the one-quarter inch of the center line of the journal; then place the front piece. No packing should be placed at the side of the journal. If the box requires additional packing, it should be placed in the front and "spudded" back under the collar of the journal. A good man at this work will always detect a cut journal or a brass worn thin that will cause trouble. By following these instructions hot boxes may be reduced 98 per cent. Our inspectors always ask the conductors if they have had any trouble on the last trip out, or the trip in, and just what the trouble was. Men educated in this line of work will always be interested in these results.

Every car that comes in on a repair track should be looked after, all surplus packing removed and the packing rearranged. Cars that need complete repacking should be handled as outlined above. All journal boxes should be thoroughly cleaned out before repacking. All new boxes should be free from rust and scale. The journals should be cleaned when the wheels are changed. In changing wheels see that the brass fits the journal and that the journal bearing wedge fits the brass and box properly.

A foreman in charge of inspectors should always keep in touch with the conductors and train crews to ascertain the running condition of the cars. Find out the side of the train the trouble was on. Then go over the matter with the car oiler. In many cases the conductor or one of the train crew has already told the oiler. Good results follow such co-operation.

We hold monthly meetings with our oilers, the same as we do with our inspectors. They all understand that the care of journal boxes is an important factor in getting cars over the road without delay.

*Entered in Hot Box Competition.

THE CHILLED IRON CAR WHEEL*

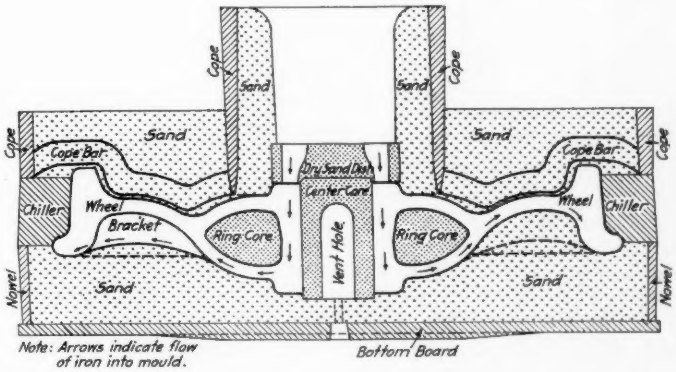
BY GEORGE W. LYNDON
President, Association of Manufacturers of Chilled Car Wheels, Chicago

The method of manufacture in so far as the formation of the wheel is concerned, is practically the same today as when first introduced. Fig. 1 shows a section of the mold in which the chilled iron wheel is cast.

The tread, or running surface of the wheel, is formed by an iron ring or chiller against which is poured the molten metal, the sudden cooling transforming the soft gray metal to a metal white in color and harder than tempered steel. This white, hard iron extends all around the tread of the wheel to a depth of one-half to three-quarters of an inch, and yields more mileage per unit of wear than any other metal.

There is no other metal known that produces so hard a tread that can be operated with safety, because if other metals can produce a tread as hard as the chilled iron wheel this same hardness will be apparent in the plates and the hub, which will therefore be brittle and dangerous to use.

A 725 lb. M.C.B. wheel is poured in about twelve seconds.



Cross Section of a Car Wheel Mould Showing the Direction of the Flow of the Metal

The molten metal is then subjected to different cooling conditions due to the complexity of the mold. In consequence shrinkage strains are encountered which must be relieved before the wheels are placed in service. During the earlier periods of manufacture, after the wheel was set, it was covered with ashes or hot sand and allowed to remain several days until nearly cold. Another method was to lay the wheel on the floor and apply heat to the tread, so that the temperature of the tread would be brought back to that of the plates and hub.

These crude methods were later displaced with the intro-

*Abstract of a paper presented to the Canadian Railway Club.

duction of cooling pits lined with fire brick, each pit holding from 10 to 15 wheels. Just as soon as the wheel is solidified it is removed from the mold red hot and placed in a pit maintained at the proper temperature, and by this process the tread and the plates and the hub resume an equilibrium of temperature. The wheels remain in the pits for several days until the shrinkage strains are finally removed by the gradual and uniform cooling process.

INCREASES IN CAR CAPACITY AND WHEEL WEIGHTS

A 33-in., 525-lb. chilled iron wheel of the Washburn type became standard soon after the year 1850 for 10-ton freight cars and also for passenger cars. Cars of this capacity remained standard for about 30 years. Under the conditions of light wheel loads, small flange pressures, slow speeds, low annual mileage, which prevailed during that time, the wheels would last the entire life of the car. Wheel mileage obtained under such circumstances is sometimes erroneously used to indicate the superior service of wheels manufactured at that time. The ton-mileage, which is the true basis for comparison, was extremely low as compared with wheel performance at the present time.

The 30-ton car, introduced in 1885, was the heaviest capacity car on any railroad during the time of the World's Columbian Exposition at Chicago in 1893. Its growth was very rapid on all railroads. A chilled iron wheel weighing 600 lb. was used under cars of this capacity and was recommended as standard in 1904 by the Master Car Builders' Association. It was later modified and the weight increased to 625 lb. in the year 1909, upon the recommendation of our association. It was not long before the 40-ton and 50-ton car were developed for the coal carrying trade

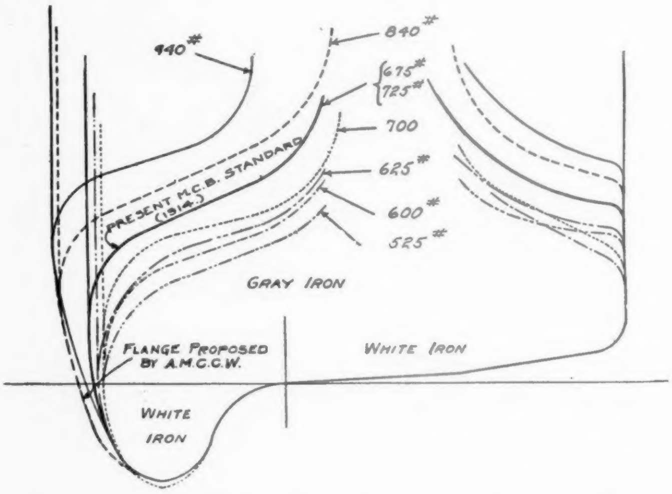


Fig. 2—Development of the Wheel Flange and the Flange Recommended by the Association of Manufacturers of Chilled Car Wheels.

and found to be so satisfactory that cars of lighter capacity ceased to be built for this service. The 700-lb. wheel was used under 50-ton cars and was recommended as standard in 1904 by the M. C. B. Association, but afterwards, upon the recommendation of our association, the weight was raised to 725 lb., and made standard in the year 1909. During the time intervening a new wheel was introduced of the rolled steel type and the steel wheel substituted for the 700-lb. chilled iron wheel weighed a minimum of 750 lb.

Cars of 70-ton capacity have already proven successful from every standpoint and are being made in comparatively large numbers at the present time.

Since the year 1875 the weight of the car structure has increased from 18,000 lb. to as high as 65,000 lb., or 260 per cent increase. The weight of rail has increased from 50 lb. to as high as 125 lb., or 150 per cent. The axle has increased from 350 lb. to 1,070 lb., or 200 per cent. The weight of the wheel has increased from 525 lb. to 725 lb., or 38 per cent. It will be noted that the percentage of increase in the wheel is much less than that for any other part of the car, and while the carrying capacity has increased from 10 tons to 70 tons, or 600 per cent, the weight of the heaviest M. C. B. standard wheel has increased only 38 per cent. The ton-miles per annum of the present 70-ton car is approximately 20 times that of the 10-ton car, which indicates the greater service given by the present wheel than was secured from any wheel during the pioneer days. It also plainly shows that the mere comparison of mileage is of no value unless the load carried is taken into consideration.

THE FLANGE

There is one part of the wheel that has received scant consideration and that is the flange. During all the remarkable railroad development the space between the running rail and the guard rail has remained fixed at 1¾ in. The chilled iron wheel manufacturers have been trying for years to secure a stronger flange and have demonstrated the fact that 3-16 in. can be added to the thickness of the present M. C. B. flange by mounting each wheel 3-32 in. closer to the rail and still maintain the Master Car Builders' standard throat to back of flange dimension of 4 ft. 6 29-64 in. This insures that the relation of the back of the flange to guard rail remains the same as at present and no change in track clearance is required. We have received the approval of our plan from a special committee who were appointed for the purpose of investigation through the American Railway Engineering Association. Our recommendations are shown in Fig. 2, which also shows the development of the flange and tread.

Under the 10-ton car, the weight of which was about equal to its capacity, the load carried per wheel was approximately 5,000 lb., which would require about 4,000-lb. flange pressure to change the direction of the truck in engaging curves. Under the 70-ton car the load per wheel has increased to 25,000 lb., which requires almost 20,000 lb. flange pressure to change the direction of the truck; therefore, the flange thrust has increased 400 per cent on account of the increased load, which is further augmented by the high speed of modern freight trains. Under present conditions of operation, considering the increased load and speed, the thrust on the flange including impact is at least 10 times greater than under the old 10-ton car; it must be apparent that the increased duty has not been provided for.

Tests made at the University of Illinois for the purpose of ascertaining the stresses to which the wheel is subjected in pressing it onto the axle and under service conditions, have shown that when a wheel is pressed on an axle a compressive stress is developed radially and a tensile stress circumferentially; that the plate must carry the load which produces a combination of stresses resulting in a wheel slightly elliptical; that on descending grades the heat generated by the brake shoe, which is a factor of load, grade and speed, causes a tensile stress in a radial direction in opposition to the compressive stress which was developed while pressing the wheel on the axle, and that the heavy flange thrust causes a bending action in the plate, which intensifies the tensile stress developed by the heat in the front plate and the compressive stress in the back plate developed while pressing on the axle.

The ratio between these stresses developed in the 70-ton car as compared to the 10-ton car is much greater than that indicated by the mere increase in carrying capacity. The heaviest stress developed is probably that caused by the sudden rise in the temperature of the tread of the wheel from brake shoe application on descending grades.

RECOMMENDATIONS

Our association believes that due to the general conditions confronting us today and considering the safety factor of

operation that three designs of wheels, viz.: 675 lb., 750 lb. and 850 lb. (with 3-16-in. increase in flange) for 30-ton, 50-ton and 70-ton cars, respectively, would, in a great measure, solve our present troubles and our recommendations would be:

675 lb. wheel for cars having a maximum gross load of 112,000 lb.
750 lb. wheel for cars having a maximum gross load of 161,000 lb.
850 lb. wheel for cars having a maximum gross load of 210,000 lb.

COST

The 8,000,000 tons of chilled iron wheels running today possess a higher relative market value when worn out, based upon their first cost, than is usual with other commodities purchased by the railroads. Hundreds of thousands of chilled iron wheels have been sold at a differential of $10 per ton, which represents the difference between the original selling price and the scrap value of the old worn-out wheels, and this $10 per ton differential represents the cost of reconverting the old wheel into a new one plus the necessary labor, plus the price of the new material and the profit of the manufacturer. About 30 per cent of all wheels sold are removed by foreign lines and the price paid for these removals is fixed by the printed interchange rules of the Master Car Builders' Association, as follows:

	Chilled Iron	Steel
New value, each	$9.00	$19.50
Scrap value, each	4.75	4.50
Net cost	$4.25	$15.00
Cost of removing from and replacing in trucks, per pair, $2.25, each	1.12	1.12
Cost under car, each	$5.37	$16.12
Cost of two turnings		3.25
Total cost of wheel service, each	$5.37	$19.37

It will be observed that the total cost for wheel service for other types of wheels is about four times that of the chilled iron wheel and upon this basis of comparison any substitute must yield four times the mileage or time service in order to equalize the cost.

Chilled iron wheels sold at a differential of $10 per ton makes the net cost of the three Master Car Builders' standards as follows:

625 pounds MCB wheel for 30 ton cars—$3.12
675 pounds MCB wheel for 40 ton cars— 3.37
725 pounds MCB wheel for 50 ton cars— 3.62

All chilled iron wheels, unlike other types, are guaranteed for the minimum service. The cost per year with the guarantee is as follows:

Maximum net cost of 625 lb. MCB wheel guaranteed for 6 years—52 cents per year.
Maximum net cost of 675 lb. MCB wheel guaranteed for 5 years—67 cents per year.
Maximum net cost of 725 lb. MCB wheel guaranteed for 4 years—90 cents per year.

Any wheel that is sold for $20 will cost the railroad, in interest charges alone (figured at 5 per cent per annum), more than the renewal charges of the chilled iron wheel, because while the guaranteed net cost to the railroads is based upon six, five and four years' service, respectively, the actual service is often twice as much. During the last two years the prices of all commodities have reached their highest figures. Nevertheless, the price of the chilled iron car wheel has practically remained constant.

We have not yet reached the capacity of the chilled iron car wheel and to-day we have in service wheels weighing 950 lb., which are 225 lb. heavier than the heaviest M. C. B. standard. These wheels are carrying a burden of 26,500 lb. per wheel and they have given such satisfactory service under engine tenders of 12,000 gal. capacity that no other type of wheel is considered by the user.

INSOLUBLE IMPURITIES IN OIL.—Insoluble impurities in oil can easily be detected (although the nature of them cannot be determined) by mixing a quantity of oil with gasoline so that it will filter through blotting paper. Any such impurities are deposited on the paper, and can be seen.—*Power.*

DERAILMENTS DUE TO DEFECTIVE EQUIPMENT*

BY WILLIAM QUEENAN
Assistant Superintendent Shops, Chicago, Burlington & Quincy, Aurora, Ill.

During a period of 21 months, beginning December 1, 1914, and ending September 1, 1916, one of the western railroads had 350 derailments caused by defective equipment. These derailments had 44 different causes; 189 of them were on equipment owned by the railroad and 161 on foreign equipment. The table shows a list of the causes and the number of derailments from each cause, divided according to the ownership of the cars. The derailments recorded under the last four items in the table, were each the result of a separate cause and have been roughly grouped in four classes.

Defects	Cars: Owned	Cars: Foreign	Total
Brake beam down	35	36	71
Broken wheel	21	15	36
Coupler pulled out	17	16	33
Broken journal	10	17	27
Burst air hose	21	5	26
Burnt journal	11	12	23
Loose wheel	9	11	20
Broken flange	16	4	20
Broken arch bar	5	5	10
Broken axle	3	6	9
Broken oil box bolts	4	4	8
Broken truck sides	4	3	7
Broken brake rod	3	3	6
Sharp Flange	3	2	5
Broken brake hanger	2	3	5
Broken knuckle	5	..	5
Broken truck	1	3	4
Brake rod down	2	2	4
Draft timbers pulled out	..	3	3
Worn knuckle	2	..	2
Broken train line	1	1	2
Broken equalizer	2	..	2
Miscellaneous truck defects	5	6	11
Miscellaneous underframe defects	5	1	6
Miscellaneous brake rigging defects	2	1	6
Miscellaneous coupler defects	..	2	2
Total	189	161	350

The 71 derailments caused by the dropping of brake beams are a little more than 20 per cent of the total number of derailments recorded. This is entirely too many accidents traceable to one cause. That this particular cause of derailment is not confined to any one railroad, however, is well brought out by the statement contained in the 1915 Proceedings of the Master Car Builders' Association, showing that about 37 per cent of the derailments of one eastern road resulted from this cause.

The most frequent cause of dropped brake beams is the loss of brake hanger pins. These pins are secured in several ways; the most common practice is to use a cotter or split key, or a common nut with a lock nut. No matter which of these fastenings is used, its security depends entirely upon the care with which it is applied. Frequently the nut is not turned up on the bolt sufficiently, or the nut lock is left off entirely, or the cotter key may not be split sufficiently to prevent it from working out of the hole in the pin. What is needed is a device by which the pin becomes automatically locked in place when it is inserted. I believe that such a device can be developed and when it is it will do away with a great many derailments resulting from dropped brake beams.

The accidents from broken or defective wheels and axles emphasize the fact that cars cannot receive too careful inspection. In many railroad yards car inspectors are burdened with other duties, such as taking seal records, opening the doors of box cars and examining the contents, which frequently interfere with their primary duty of inspecting freight cars for mechanical defects. It is much better to employ other help to secure seal records and the many other records which car inspectors are sometimes asked to get, than it is to allow this class of work to interfere with the principal duty of the inspector.

The derailments caused by the pulling out of couplers and

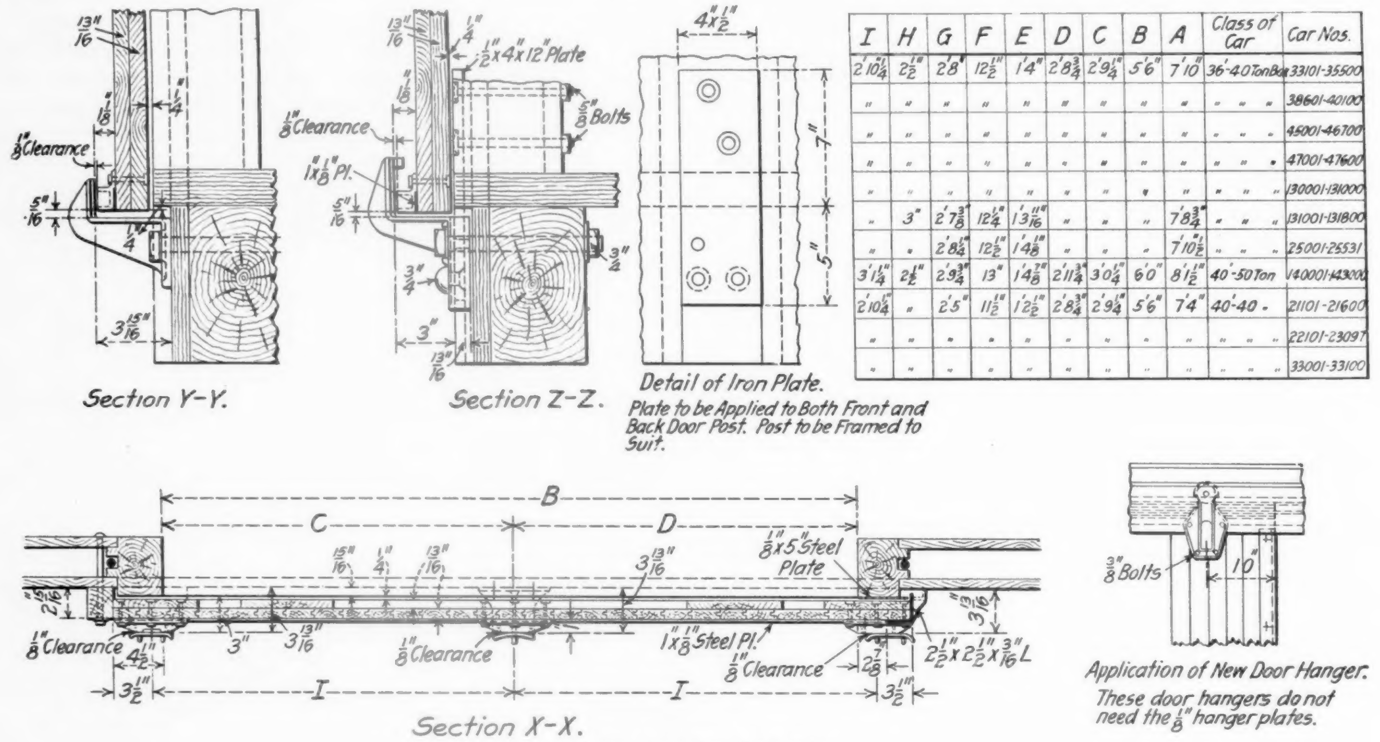
*From a paper read before the Car Foremen's Association of Chicago.

draft timbers are mostly the result of operating old, low capacity cars in heavy trains.

Derailments caused by bursted air hose are difficult to prevent. The ordinary inspection of air hose is not likely to detect hidden defects in the hose. The outer casing of air brake hose checks from different causes; this allows moisture to penetrate to the inner fabric, causing it to decay until it is unable to withstand the pressure and it bursts. A better quality of air brake hose should reduce these derailments.

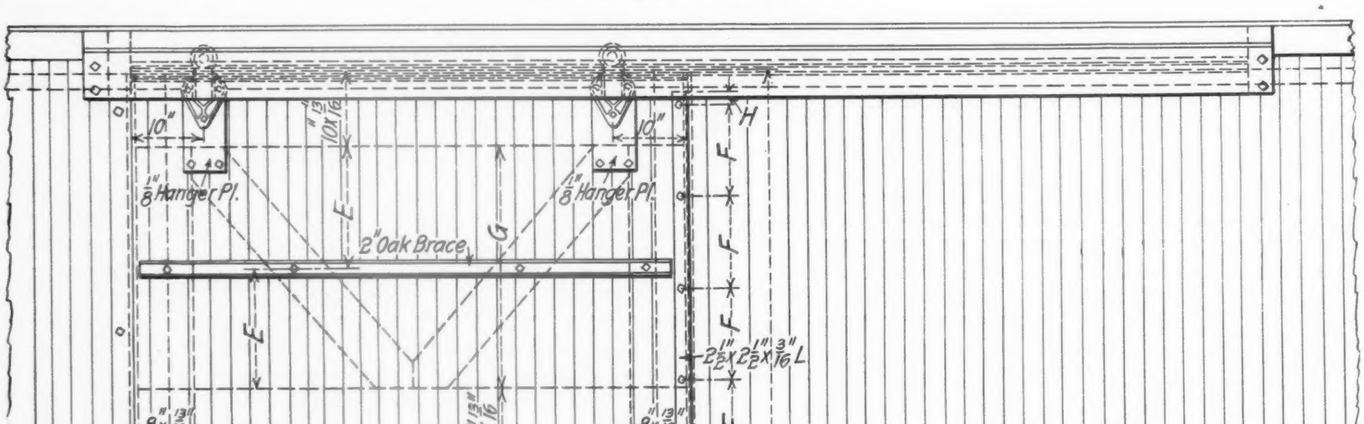
BOX CAR SIDE DOOR

In a paper on Freight Car Repair Problems presented before the Car Foremen's Association of Chicago by Lewis K. Sillcox, mechanical engineer, Illinois Central, the drawings of a box car side door were shown. This door has been applied to several thousand cars and has given excellent service. It is shown with its details, in the illustrations. The body of the door is made up of 13/16-in. matched boards,



I	H	G	F	E	D	C	B	A	Class of Car	Car Nos.
2' 10 1/4"	2 1/2"	2' 8"	12 1/2"	1' 4"	2' 8 3/4"	2' 9 1/4"	5' 6"	7' 10"	36'-40 Ton Box	33101-35500
"	"	"	"	"	"	"	"	"	" " "	38601-40100
"	"	"	"	"	"	"	"	"	" " "	45001-46700
"	"	"	"	"	"	"	"	"	" " "	47001-47600
"	"	"	"	"	"	"	"	"	" " "	130001-131000
"	3"	2' 7 3/8"	12 1/4"	1' 3 11/16"	"	"	"	7' 8 3/4"	" " "	131001-131800
"	"	2' 8 1/4"	12 1/2"	1' 4 1/8"	"	"	"	7' 10 1/2"	" " "	25001-25531
3' 1 1/4"	2 1/2"	2' 9 3/4"	13"	1' 4 7/8"	2' 11 3/4"	3' 0 1/4"	6' 0"	8' 1 1/2"	40'-50 Ton	140001-143000
2' 10 1/4"	"	2' 5"	11 1/2"	1' 2 1/2"	2' 8 3/4"	2' 9 1/4"	5' 6"	7' 4"	40'-40 "	21101-21600
"	"	"	"	"	"	"	"	"	" " "	22101-23097
"	"	"	"	"	"	"	"	"	" " "	33001-33100

Details of Box Car Side Door



Substantial Side Door for Box Cars

reinforced at the back by 10-in. by 13/16-in. boards at the top, middle and the bottom, and by diagonal braces extending between these members. At both ends there are vertical strips of the same material eight in. wide. On the front, two longitudinal oak braces two in. thick, located as shown in the elevation, give additional stiffness to the door.

A 5-in. by 1/8-in. steel plate is fastened to the back door post for its full length, forming the weather strip. A 2½-in. by 2½-in. by 3/16-in. angle on the back edge of the door overlaps this weather strip when the door is closed. The door is hung on rollers at the top. Three door guides are used to hold the door in place when it is closed. The two end guides are riveted to a ½-in. by 4-in. by 12-in. plate which is bolted to the side sill and door posts as shown in section Z-Z. With this construction it is impossible to remove the guides from the outside of the car when the door is closed, without cutting the rivets. A strip of steel plate 1 in. by 1/8 in. along the bottom of the door protects the body of the door while it is being opened and closed.

THE CAR DEPARTMENT APPRENTICE*

BY FRANK DEYOT, JR.
Chief Draftsman, New York Central Lines, East Buffalo, N. Y.

From experience with car department apprentices I have found that it is a hard problem to keep up their interest in the work because of the seeming lack of inducements and the laborious work they are called upon to do in repairing freight cars. It has also been difficult to convince a boy that the carpenter's trade could be taught thoroughly in a freight car repair shop. However, first class car men can be obtained through a combined system of training both in the shops and classrooms. The boys should be instructed by expert car men who can exert the proper discipline. They should be trained in all branches of the work at a car shop, especially where new work is done as well as reconstruction work. The boys should be about 18 years old and should have a fair grammar school education. They should be required to pass a suitable examination before being allowed to enter the apprentice course. The length of the course should be three years and the boys should be started in the department where the work is most likely to appeal to them. They can then be advanced into each department as they become qualified.

Problems which constantly arise in the course of shop training should be taught in the classroom and a sufficient amount of car drawing should be taught to enable the apprentice to read a drawing, make such free-hand sketches and perspective drawings as are often found necessary in car work. If the boy is given to understand that he is not there to become only a car repairer, but that he is expected to qualify himself for something better, there will be no trouble in getting a good class of men and keeping them.

There is another obstacle confronting the car department apprentice and that is the wages paid. The time has gone by when you can get a young man of intelligence to work for a meagre salary just because he is learning a trade. This fact has been found to be true by the smaller concerns who employ apprentices at nearly a journeyman's rate to induce the young men to learn the trade in order that they may be developed into foremen and other official positions.

Another way to make apprentice work attractive in the larger shops, and where there is a sufficiently large number of apprentices, is to organize an apprentice club. Quarters can be fitted up in some part of the shops, or close by, where the boys can assemble in the evening and discuss papers on the different classes of work and play games suitable to young men. A baseball club may be organized also and managed by those interested in the apprentice work.

* Entered in the Apprentice Competition of the Chief Interchange Car Inspectors' and Car Foremen's Association and presented at the annual convention, Indianapolis, Ind., October 3, 4 and 5, 1916.

STEEL GONDOLA VERSUS COMPOSITE GONDOLA*

BY WILLIAM QUEENAN
Assistant Superintendent Shops, Chicago, Burlington & Quincy

In the last few years many articles of interest have been written with regard to the steel gondola car. These writings touch on the probable life, cost of repairs, proper care and detail of construction. In a review of the subject it would appear that the gondola of composite type has not received the same consideration given the all steel car.

The Chicago, Burlington & Quincy has over 18,000 all steel gondola cars in service. These cars range in age from two to thirteen years and compare very favorably, as to condition, with those of like construction owned by other roads. They are all 40 ft. 50-ton capacity, drop bottom cars, having from 12 to 16 doors, with an average light weight of 38,800 lb. and are of different designs, seven car companies participating in their manufacture. This road also owns 1,000 composite gondola cars.

COST OF REPAIRS

A record of the cost of repairs to individual classes of freight cars has been in operation upon this road for about two years and some very valuable information obtained.

In the year 1903 the 1,000 composite gondola cars before mentioned were built. These cars are 40 ft. in length, 50-ton capacity, with steel side stakes and underframing, wooden sides, ends, floors and drop bottom doors. The lumber used was 2¼ in. and the light weight of one of these cars is 39,700 lb. In the same year 1,000 all steel gondolas were built. These cars are 40 ft. in length, 50-ton capacity, and have drop bottom doors. The side sheets and door plates are ¼ in. thick. The light weight of these cars is 37,800 lb.

During the 12 months ending August 31, 1916, 167 of the composite gondola cars as described were repaired at one of the company's largest shops, at an average cost of $21.82 per car (truck repairs not included). Of this amount $2.53 was spent on the draft rigging, $11.28 on the underframe and $8.01 on the body of the car.

During the same period 332 of the all steel gondola cars before mentioned were repaired at the same shop, at an average cost of $29.77 per car (truck repairs not included). Of this amount $3 was spent on the draft rigging, $10.18 on the underframe and $16.59 on the body of the car.

Repairs to the draft rigging include couplers and attachments, draft castings, uncoupling devices, short draft sills or plates, buffer blocks and all other parts of draft gear. Repairs to the underframe include all sills, body bolsters, body center plates, body side bearings, cross bearers, dump doors, and operating mechanism. Repairs to the body cover all parts of it including the floor.

It is the aim of this road to keep its cars well painted and during the period of one year 14 of the composite cars were repainted at one shop at an average cost of $3.81 per car, and 42 of the before described steel cars were painted at a cost of $2.83 per car.

Records show that the total repairs on the entire system which includes trucks to the composite gondolas cost as follows per month:

Average per car repaired	$5.25
Average per car in service	3.08
Number cars repaired	600
Number cars in service	999

This compares with cost of repairs to the all steel gondolas before mentioned as follows per month:

Average per car repaired	$6.73
Average per car in service	4.80
Number cars repaired	710
Number cars in service	987

STEEL GONDOLA CARS

In 1911 after eight years of service the drop doors on the steel gondola cars before described had become worn and dis-

*Abstract of a paper presented before the Western Railway Club.

torted considerably and on account of a faulty door operating mechanism the operating mechanism was removed, the door straightened and closed permanently. Four years later, in 1915, these door sheets had rusted to such an extent that they were unsafe, and after going into the matter thoroughly to determine whether new steel doors should be applied or not it was finally decided that new steel doors would outwear the sides and that the economical thing to do was to put in solid wooden floors, which is being done. The wooden floor will give good service for five years.

A year ago the work of reinforcing the doors on steel gondola cars built in 1906 and 1907 was begun. These doors are rusted and worn so badly that a new door plate is required. It is also found that some of the doors are not worth repairing in this manner and new doors must be made complete. The center cover plate and end floor sheets in all of these cars are worn very thin and will soon have to be renewed.

As will be seen, corrosion is the greatest enemy of the steel car. A great deal toward the prevention of outside rust can be accomplished by taking care of the small rust spots when they are first discovered. They should be thoroughly cleaned and painted.

While the outside of the car body may be kept in good condition as regards the rust, it will be found that on all steel cars corrosion on the inside usually starts within a few months after the cars have gone into service, and within two years the inside of the body, floor, drop doors and underframe will show very materially the effects of the rust.

Experiments have been made as to painting and oiling insides of steel gondola cars, but it has been found that this paint or oil is rubbed off so quickly that it does not pay. Good results can be accomplished by sand-blasting of steel cars, but few roads spare the time and outlay of money that this practice requires. Most roads are endeavoring to keep their steel cars well painted, for if the outside corrosion can be stopped the life of the side and end sheets will be prolonged.

It would appear that steel cars operated in low damp regions are more susceptible to corrosion than those used in higher and dryer climates, and cars used in bituminous coal hauling are undoubtedly affected by corrosion more than cars used in hauling anthracite coal. The practice of loading cinders in steel gondolas is very objectionable; when wet the acid in the cinders will attack the steel, and if they are not wet down good before loading they are often so hot that they will burn off the paint.

The practice of unloading coal from gondolas with a clam shell bucket is bad; if the operator is not a careful man a large amount of damage will be done to the floors and sides of the cars. The practice of loading freight car trucks in gondola cars with drop doors in bottom is bad and does a large amount of damage.

COMPOSITE GONDOLA CARS

The composite gondola cars built in 1903 before mentioned and described are still in very fair condition. A large portion of the original lumber is still in them. Repairs outside of that to the draft gear and trucks consist principally of renewals of the end and drop door planking. Floors in some places also need attention. The steel parts where they are protected by the wood-work are in good condition. These cars have given very good service.

Owing to the small number of composite cars as compared with the large number of all steel cars, the writer will not try to say which of the two types are the best, but rather try and point out some of the good points of both types.

CONCLUSIONS—IN FAVOR OF THE ALL STEEL CAR

Some of the repairs to all steel cars can be made without removing the defective parts from the car.

Outside of extensive damage, defective parts can be straightened and used again, thus reducing material cost.

If the floor and drop door sheets, cover plate and the bottom of the side sheets where they are riveted to an angle were reinforced or made of heavier steel than the main portion of the side and end sheets, the cost of repairs would be reduced, and the life of these parts lengthened so that they would last as long as the side and end sheets.

The salvage value of the all steel car is much greater than the composite type of car.

For the first three or four years the cost of repairs, barring accidents, to the all steel cars is very light.

CONCLUSIONS—IN FAVOR OF THE COMPOSITE CAR

The initial cost of the composite gondola with the present price of steel should be less than the all-steel gondola.

The composite type of car costs less to maintain than the steel gondola.

The sides of the composite car do not bulge as do those of the steel car.

Records show that while the composite car costs more to repaint than the steel car, it does not require painting as frequently.

A large portion of the repairs to composite cars can be taken care of at other than steel car shops.

Certain properties in coal cause corrosion to steel but do not affect the wood.

INTEREST THE MEN IN HOT BOXES*

BY C. S. TAYLOR

General Foreman, Atlantic Coast Line, Wilmington, N. C.

Some time ago we were annoyed considerably with hot boxes. In each case the inspectors stated that the "boxes appeared to be in good condition leaving the terminal." I found, by personally following them up, that such was the case. I noticed also that cars would get quite a distance from the terminal before the trouble developed. I finally came to the conclusion that the difficulty was of a very small nature, to overcome which it would be necessary to examine and repack all of the boxes before leaving the terminal. This would have proved most expensive and could not be done with the forces on hand.

We have very few through cars at the terminal, as all of the business either originates there or is for export. Cars come into the terminal and are placed at the export wharves or at some industry and probably stay in the yard for several days. Of course, the inspectors examine all boxes when the cars start out. The adoption of the following plan reduced our hot-boxes practically more than 50 per cent:

The inspectors are instructed to go over a train on its arrival and feel the boxes; if they are the least bit warm they mark them with a piece of blue chalk. Nobody is authorized to rub this chalk mark off except the car oiler, and when trains are made up to go out the car oiler goes over them. If a box lid is marked with blue chalk, his instructions are to examine the brass and pack the box. Quite frequently he finds a hard spot in the brass or the packing is dry; the boxes from a casual observation or inspection, however, would appear to be in good condition. Under the former practice the inspector would raise the box lid and if the packing and brass appeared to be in good condition he would only stir the packing up, getting the saturated dope in the bottom of the box up next to the journal. Under the new method, when he sees the blue chalk mark he knows the box came in a little warm, indicating that there was some hidden trouble which must be remedied. After giving attention to the box he rubs the blue chalk marks off. This method, as before stated, has reduced our hot boxes about 50 per cent.

I followed up personally the attention that inspectors and car oilers were giving boxes and got them enthused with the handling of this matter, showing them the saving that we would effect by the proper and economical use of oil, as well

*Entered in the Hot Box Competition.

as how expensive it is in the locomotive fuel consumption and delays to have to stop trains to pack boxes.

It has been my experience that the best method to get results is to work with the men who are actually doing the work, instead of driving them; show them that the dollars saved by them for the company will finally revert back to them in increased wages and better working conditions. Or in other words, work up a better interest in the company's business by trying to teach them that they are just as much a part of the company as the foremen.

CO-OPERATION BETWEEN YARD AND CAR REPAIR FORCES*

BY R. H. DYER
Norfolk & Western

Co-operation between the yard and car repair forces is essential for the promotion of business, as well as the economical handling of terminal yards. Freight will be delayed and cars await repairs, attended by much loss of time and efficiency, when the two forces fail to work in harmony with each other. While the car repair forces by holding up cars for repairs may interfere with routine terminal movement of the trains, they are as much interested in the prevention of delays and keeping the number of bad order cars down to the lowest possible figure as the operating department.

The trouble, work and anxiety of a car repair force really begins with the appearance of defective equipment. Many times, to their sorrow, they see the fruits of their labor terribly abused, and their days of labor and the expense for which they are responsible and must account for, torn asunder in one shifting movement by a yard crew. Unfortunately it is often felt by some repair forces that such destruction is attended by indifference on the part of those in charge of the yard.

There may be, and undoubtedly is, an economical speed at which the cars should be shifted, time and damage to the equipment considered, and the humble car repairers who witness the damage and are required to explain why there are so many bad order cars and why there is an increase in the cost of maintenance, are not uninterested parties. In the days of the link and pin coupler the train crews instinctively regulated the movement of the cars and made couplings at moderate speeds not solely for their convenience but for their personal safety as well. Equipment under such treatment receives the least abuse, but since the introduction of the automatic coupler which permits more severe practices without danger of personal injury there seems to be a lack of interest in the preservation of equipment. Personal safety that accompanies the introduction and development of the automatic coupler, application of air brakes, etc., is having its reward. Still the number of injuries which are the result of carelessness and the unnecessary taking of chances is appalling. It matters not from the shopman's point of view whether the cars are destroyed by jerking or buffing, although the latter is the more serious. The thought naturally arises that greater team work could be obtained if the yard forces could be made to appreciate the losses from the rough handling of equipment.

In the interest of co-operation the yard forces and inspectors should, in the handling of loaded cars requiring transfer, decide as soon as possible what cars are to be so handled in order that the yard forces may move the car direct to the transfer track, and avoid any delay incident to a shift to the repair track for further inspection. The yard forces should work, in such cases, in harmony with the repair men and expect as much in return. Ordinarily, the open hand must first come from the yard people with their assurance of support and co-operation, and they should also encourage a free exchange of views for the common efficiency. When car foremen select cars for certain classes of lading they should endeavor to give the yard people as little switching to do as possible.

The handling of box cars at terminals where such equipment is extensively used is a most important matter, and one offering many opportunities for the exercise of good judgment. Inasmuch as it is generally the rule that these cars are not kept up to a high standard of physical condition, the yard people are confronted with a task of handling cars to the best advantage, disposing of them at the least cost and loss of mileage. Hence cars not serviceable for the highest class of freight must be utilized as the conditions permit. This includes the disposition of the foreign box car equipment having more or less defective superstructure and where a prohibitive length of time will be required to get repair material from the home road.

The yardmasters can be of great assistance to their repair forces by giving them advance information concerning the cars desired for delivery. Ordinarily the inspectors do not know what is in contemplation until the work arrives. As a result the cars will have to be inspected and repaired hurriedly and in many cases the train will be delayed. The handling of perishable freight and livestock is also of importance. Yard forces usually obtain due notice of such shipments, but very often the information is slowly handled, or not given to the repair forces at all. Hence they are left in more or less ignorance until the cars are discovered in the yards. Under such circumstances delays, often more or less serious, occur, whereas, if a little information had been given this might have been prevented.

The car foremen should require the car inspectors and repair men to furnish prompt information to the yard forces regarding the cars that should be shopped out of a train, giving them the initials and the numbers of the cars in order to assist the crews in switching them. In the larger yards where bad order cars are classified on special tracks, much has been accomplished by the inspectors indicating the light and heavy repairs by attaching a small red or white card to the side of the cars. This enables the switching crews to tell at a glance, and at some distance, where the shop cars are located and also where they should be placed so that the repairs may be made to the best advantage and with the least loss of time. The yard forces should be told of and be made to appreciate the importance of properly classifying the bad order cars on the shop tracks. These tracks should be laid out with respect to the classification yard, for the convenience of all concerned.

There is always some advantage to be gained in keeping repair organizations together, so that the material and facilities may be close at hand and not spread all over the property. At the same time car repair foremen will generally prefer to separate the car repair yards in preference to increasing the amount of shifting to be done to the bad order cars, unless possibly the shifting engine is under the car repair foreman's charge, in which case the work is always handled to the best advantage and with greater care. When cars are once damaged, particularly the draft gear, end or center sills, additional handling means that they are often subjected to further serious damage. It is believed by some car men that the shifting question is probably responsible for three-fourths of the damage, and many car repair forces which are given the opportunity to express their views on the layout of yards will, in a general way, advocate carrying the material to the point or place in the yards where bad order cars naturally assemble, or where they are taken out of the trains, as against depending on shifting the cars any distance to reach the common yard.

Another matter which should be given the most careful

* From a paper read before the annual convention of the Chief Interchange Car Inspectors' and Car Foremen's Association, Indianapolis, Ind., October 3, 4 and 5, 1916.

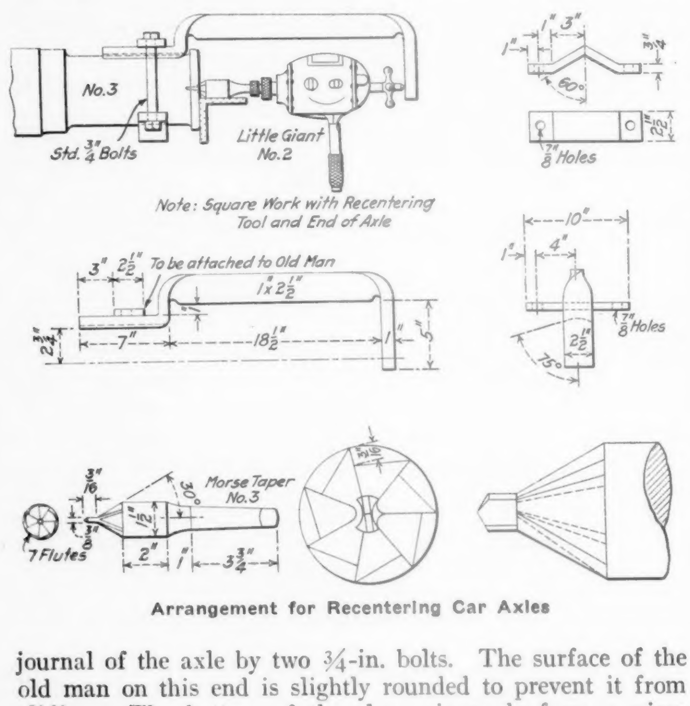
consideration by both the yard and car repair forces is the blue flag. The yard forces, both mechanical and transportation, should hold the blue flag in the highest respect and keep in mind that it is put on a car or a string of cars not to handicap operation but to protect the life of the employees. Again the car forces should remember that repairs should be made as quickly as possible and never allow the flag to remain longer than is absolutely necessary to protect themselves.

It is evident that the car repair force is an important factor in the transportation problem as through its efforts it is possible to keep the equipment moving with safety. At the same time it is only by the closest co-operation between the yard and the repair forces that it is possible economically to handle the movement with despatch. If co-operation does not exist to the highest degree and the car repair forces are not given the best opportunities for doing their work, the work can only be done at a greatly increased cost and with possibly a serious delay to the traffic. Good yard management should regard the car repair forces as truly assistants and offer them every means quickly to repair and return to service equipment taken out of the trains. While the car repair work may appear to be a necessary evil it is one of the normal conditions in railroading and it should be recognized that any delay to the rapid execution of the repairs to cars is expensive in many directions, viz.: in the cost of repairs itself, in the delay to the cars, in the value of the car, in the loss of revenue and, last but not least, in that it may cause embarrassment to the shippers. So important is this question of co-operation between the yard and repair forces that the general offices should assist in its encouragement to the greatest degree.

RECENTERING CAR AXLES

BY E. A. M.

It is difficult and expensive to recenter a car axle on a lathe, especially where a large number have to be recentered. With the device shown in the illustration this can be done at a small cost. It consists of an old man made from 1-in. by 2½-in. material, twisted as shown to form a back rest for a small air motor. One end of the old man is clamped to the



Arrangement for Recentering Car Axles

journal of the axle by two ¾-in. bolts. The surface of the old man on this end is slightly rounded to prevent it from sliding. The bottom of the clamp is made from a piece of 2½-in. by ¾-in. material. The construction of the drill used for this purpose, has a point ⅜ in. in diameter and 3-16 in. long with a fluted bevel for countersinking the holes. The body of the drill is 1½ in. in diameter and the shank is provided with a No. 3 Morse taper. The drill is squared as indicated in the illustration by squaring the body of the drill with the face of the axle. The feed screw is then set on the back rest of the old man. This tool has been found entirely satisfactory and saves a lot of time in recentering the axles.

INTERCHANGE INSPECTION PROBLEMS*

BY W. H. SAGSTETTER
Master Mechanic, Kansas City Southern, Shreveport, La.

To study and interpret properly the M. C. B. rules, as improved each successive year to meet the changed conditions, is the paramount duty and ambition of this organization. The present day inspector must have a good education and must be in a position not only to read, but to memorize the rules, whether they be the interchange rules, loading rules, safety appliance regulations, or special instructions issued by the company for which he is working. He must protect his company when cars are interchanged. He must be unbiased and conservative. He must be able to judge as to when a car is in safe condition to proceed, and he must expedite the movement of cars as consistently as possible. The work of this organization has been such that these men are able to determine difficult cases more quickly, clearly and accurately.

It lies within the power of the association to expedite the movement towards a systematic interchange of cars which will result in a tremendous saving. The proper step in this direction is, I believe, the establishment of joint interchange and inspection bureaus at every point where two roads interchange cars. Where there is a chance of difference of opinion, one man should handle the interchange, if possible to do so. If this is done it will be one of the greatest factors in the better movement of both loaded and empty cars.

Another subject that should receive consideration is the rules governing the transfer of loads. There is much unnecessary transferring done, sometimes through ignorance and sometimes through fear, and a great deal through the spirit of reciprocity. The latter condition usually prevails at points where more than one inspector is located. One inspector feels that a certain car has been transferred on technicalities, and he compels a transfer on technicalities to get even. In both cases the railroads hold the sack and pay the money. One of the principal causes for transfer of loads is elongated holes in draft sills. Why not recommend that the holes be worn 2 in. or 2½ in. before transfer authority be given?

Another matter that needs consideration is the technical carding of cars. This is brought very forcefully and frequently to our attention on carding for raked siding. Why not recommend that before a card be given for raked siding it must be raked into the tongue and groove of the siding and that the roofing raked on the ends must be split inside the facia board before a defect card is given. We must depend upon such an organization as this eventually to work out the undesirable features that are found in connection with the interchange of cars today.

Human Element in Accident Prevention.—Railroad and industrial statistics indicate that only about 10 per cent of all accidents to employees are of a character which mechanical safety devices, or the previous correction of unsafe conditions, will prevent. The other 90 per cent are largely of a character which can only be prevented by the exercise of greater care on the part of the human beings involved in the accidents. Therefore, the principal avenue in which our accident prevention effort must be directed is in the education and supervision of the human forces.—*Marcus A. Dow before the New York Railroad Club.*

* From a paper read before the annual convention of the Chief Interchange Car Inspectors' and Car Foremen's Association, Indianapolis, Ind., October 3, 4 and 5, 1916.

Shop Practice

SHOE AND WEDGE JOB

BY ARTHUR J. HUMPHREY

New shoes and wedges are usually planed in large quantities at a time; they are planed all over except the face and placed in stock until needed. The face is planed to the required thickness as the shoes are needed. Fig. 1 shows a method of planing new shoes and wedges. A long casting is bolted in the center of the table, and the shoes and wedges are clamped on both sides. Both planer heads are used.

The shoes are first clamped with one side up and planed. They are then turned over and the other side of the shoes

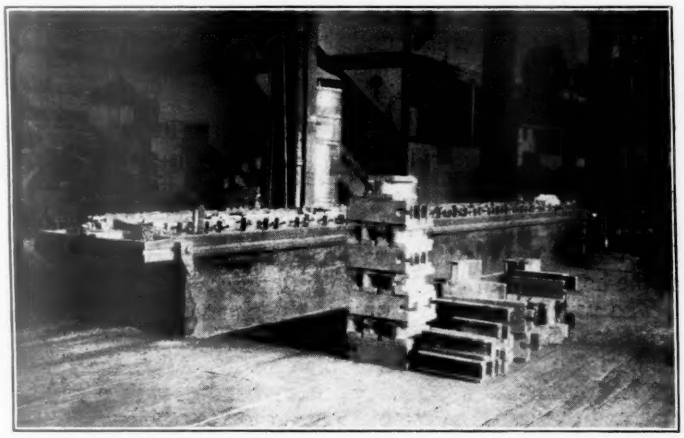


Fig. 1—A Long Table Planer Is Used for Planing Shoes and Wedges

is finished 1/32 in. narrower than the driving box channel within which they go. They are then clamped face down and a roughing cut is taken over the bottom. Two roughing tools may be used for doing this work, clamping them in the tool block about half as far apart as the inside width of the shoe; they are fed down to depth, then fed across.

After the bottom has been roughed out, both sides are planed complete and the bottom is finished in one cut with a wide forming tool. A fine feed is used in taking the cut. Fig. 2 shows the wide forming tool. It should be made 1/32 in. wider than the pedestal jaws over which the shoes are to fit. This illustration also shows the method of clamping the shoes with tool steel pins and cupped set-screws.

The wedges are planed in the same manner as the shoes, except that when the bottom is planed a block is placed under the thin edge of each wedge and adjusted till the inside face of the wedge is level with the planer table.

The next operation on the shoes and wedges is to lay them out and plane them so that when they are properly set up on the engine, the driving axles will not only be square with the engine but the distances between axle centers will be the same as the length of the side-rods.

There are several methods of laying out the shoes and wedges. The practice in some shops is to run a line through the center of one or both cylinders and to lay off the shoes and wedges in such a manner that the axle will be square with the line. Another method is to square the axle with one or both frames or with an imaginary line drawn central between the frames. Of course, if the bore of both cylinders are parallel with each other, and with both frames (as they should be) it would be immaterial which method was used. A line square with one cylinder or frame would be square with them all. If the cylinders and frames are not parallel, the shoes and wedges can only be laid out square with one of them. I prefer the method of laying them out so that the axles will be square with an imaginary line central between the frames, and will describe that method.

The binders should be bolted up, and the shoes and wedges should be put in place and held there by a light jack *A*, Fig. 3. In the two main jaws of the engine place the jacks just below the center of the wedge and equally distant from the top of the frame. The wedges should be raised 1/4 in. above the binders by placing under them a piece of iron 1/4 in. thick.

Chalk or paint the frames and the shoes and wedges where lines are to be drawn in order that the lines may be seen easily. Then scribe four lines across the front main pedestal jaws, both inside and outside, equi-distant from the top of the frame, and about midway the length of the wedge. This line is shown at *B* in Fig. 3. Place a prick-punch

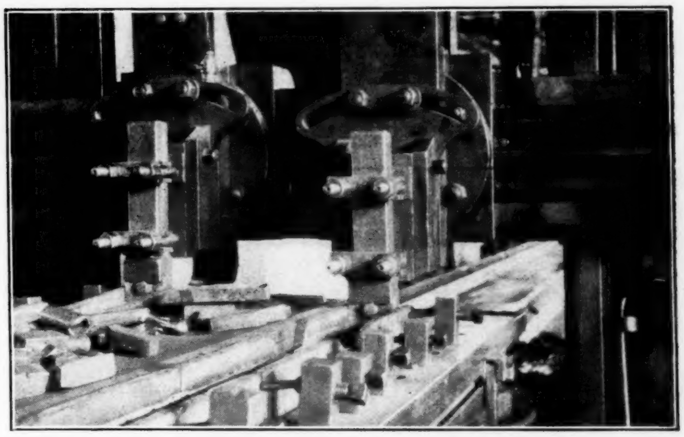


Fig. 2—Method of Planing the Inside of Shoes and Wedges

mark midway between the frames on the cylinder castings; or if it is impossible to tram back from the cylinders to the main jaws, place the mark on a frame brace, or a piece of wood wedged between the frames. Place one end of a tram in this prick-punch mark, and with the other end of the tram (this end should be bent at right angles with the tram), scribe lines intersecting the lines *B* on the inside of the front main jaws far enough ahead to clear the flange of the shoes. Prick-punch the intersection. Place a straight edge *C* across the face of the shoes and with a pair of hermaphrodite calipers adjust the straight edge till it is equally distant from the prick-punch marks on the inside of the front main jaws.

With one leg of the hermaphrodite calipers against the straight edge, scribe this same dimension on the outside of each front main jaw intersecting the line *B* at *D* and prick-punch the intersection.

Scribe a line *E F* on the engine frames above the jaws, and parallel with the top of the frames. Then scribe the

line G H through the prick-punch mark D the full length of the jaw and perpendicular to the line E F. To draw this line perpendicular to E F, take a pair of short trams set to a distance greater than from D to the line EF, and with D as a center, scribe arcs crossing the line EF. With the dividers, find a point on the line EF midway between these arcs, and draw the perpendicular line through this point and D.

After doing this on both sides of the engine, find the center of the main pedestal jaws. As the main-rods are (or at least should be) kept to standard length, a very good method of locating the main jaw centers would be to make the jaw centers a standard distance from the face of the cylinders. However, if the jaws have not become worn enough to require much filing or milling, scribe a line across EF true with the face of the front jaw, and from the point J, its intersection with the line EF, lay off on the line EF, a distance equal to one-half the standard width of the driving box, plus the standard thickness of the shoe. Prick-punch this center, which is L.

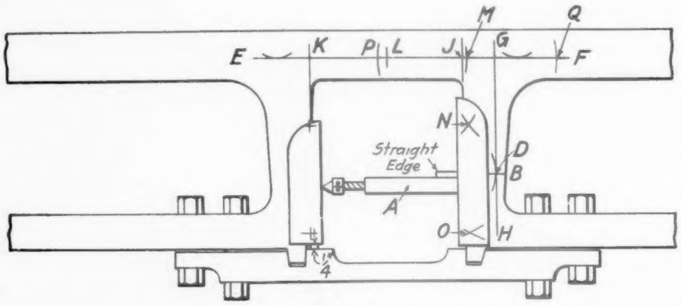


Fig. 3

Another method to be used when the jaws are worn, is to locate the jaw centers midway between the points J and K. The point K is obtained by scribing perpendicular to the line EF from a point on the face of the back jaw three inches from the top of the jaw. Whichever method is used to get the main jaw centers they both should be equally distant from the line GH; if they are not, make them so by bringing the jaw centers nearer the line GH on one side of the engine and farther away on the other.

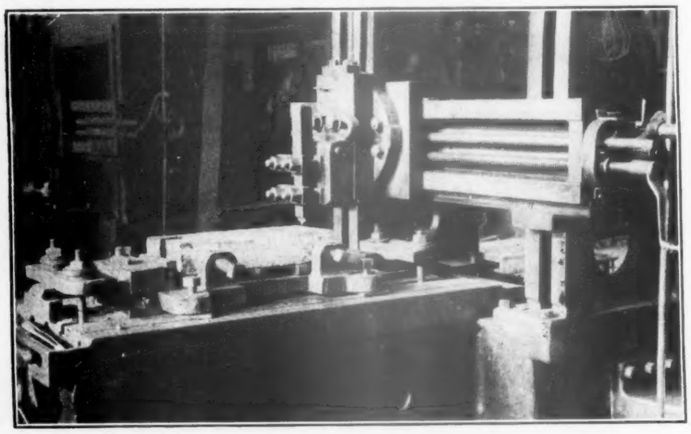


Fig. 4—Finishing the Face of a Shoe

If the driving boxes have been bored central with the shoe and wedge faces (and they usually are), caliper the box, set the dividers to one-half the distance between the shoe and the wedge faces of the box, plus one inch, and with L as a center lay off this dimension on the line EF. Prick-punch this intersection M, then on the outside face of the shoe, locate a point near each end of the shoe; these two points N and O, should be in a line drawn square with the line EF at M. To locate these two points use M as a center, and with the trams set any convenient distance scribe two arcs intersecting the line EF at P and Q. Then with P and Q as centers scribe intersecting arcs on the shoe near each end and lightly prick-punch the intersection of the arcs.

Set the dividers from either N or O to the line GH, and using as a center the prick-punch first made on the inside of the front jaw, lay off this dimension on the inside of the shoe, and lightly prick-punch. The shoe is now laid off, and it should be planed to within 1 in. of these marks, a gage being used to test the work after planing. After the finish cut has been taken, the point of the gage should enter the prick-punch mark without crowding.

The shoes on the other jaws may be laid off by tramming from the main jaw centers on each side of the engine, with the trams set to the length of the side rods and proceeding as with laying out the main shoes. If the firebox or some other obstruction prevents doing this, tram from a center located in the jaws. The most accurate method of laying off the wedges is to tram across from the shoe in three places with a tram set to the width of the driving box plus two inches.

In the above discussion it has been assumed that the shoes and wedges were new, and that the driving boxes were all bored central with the shoe and wedge bearing faces. This is not always the case. If old shoes and wedges are to be laid off and it is found there will not be stock enough to true up the face when they are planed, it will be necessary to rivet liners on the inside of them before laying them out. These should be riveted with five rivets, two on each end and one in the middle.

If the boxes are not bored central, scribe lines on the hub face of the driving box with a driving-box gage, in the same plane as the shoe and the wedge bearing surfaces, then find the distance from these lines to the center of the bore of the box and lay out the shoes and wedges accordingly.

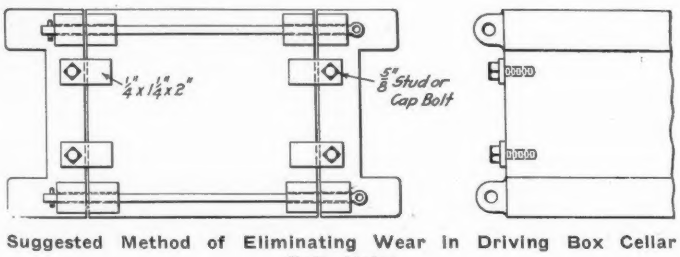
The usual method is to plane the shoes and wedges one at a time in a shaper or small planer. Fig. 4 shows a shoe held in the fixture made for planing it. After the finish cut has been taken the corners are rounded with a radius tool, and they are then complete and ready for the engine.

REDUCING WEAR IN DRIVING BOX CELLAR BOLT HOLES

BY H. C. SPICER

The holes in driving box cellar bolt lugs are always subjected to considerable wear and usually wear so rapidly that the lugs must either be replaced, or the holes filled in several times during the life of the box. This is caused by the weight of the cellar together with the constant vibration to which the bearing of the cellar bolts in the driving box lugs is subjected.

A method of supporting the cellar, which relieves the bolts



Suggested Method of Eliminating Wear in Driving Box Cellar Bolt Holes

of the weight is shown in the drawing. This is suggested as a means of eliminating the excessive wear. The cellar supports are attached to the bottom of the driving box by means of cap screws. They merely support the weight of the cellar and it is held in place in the box in the usual manner.

BOILER PATCHES FOR LOCOMOTIVES

Strength of the Diagonal Seam Compared With the Longitudinal Seam, Typical Patches Illustrated

BY M. J. CAIRNS

An article appeared in the July, 1897, issue of "The Locomotive," which is published by the Hartford Steam Boiler Inspection and Insurance Company, that covered broadly the diagonal joint winding spirally around the boiler, and attention was called to the adaptability of diagonal seams in patch work. As diamond patches, or patches with diagonal seams, are being universally applied instead of duplicating longitudinal seams, which would in most cases require welt strips, and as various methods are used in their computations, the following being an extract from the above mentioned article, is offered for consideration:

"As the strain on a longitudinal seam acts in a girthwise direction, while that on a circumferential seam acts in a lengthwise direction, usually considered as equal to one-half of the strain acting in a girthwise direction, it is apparent that a seam falling between these two seams is subjected to a strain compounded of the girthwise and lengthwise pull."

Referring to Fig. 1, let P be the pull exerted circumferentially upon a section of the shell one inch long. Then $\frac{1}{2}P$ will be the pull exerted upon an equal length of the girth joints. The total strain on the joint Z is made up of the total horizontal pull on the length X, and the total vertical pull on the length Y. The stresses acting on Z may, therefore, be summed up as follows:

First:—A horizontal pull equal to $\frac{1}{2}PX$, and

Second:—A vertical pull equal to PY.

These stresses act along the whole length of Z; so to find the stress per unit length of the diagonal joint, divide them both by Z. Hence the horizontal and vertical stresses, on each unit length of Z, are $\dfrac{PX}{2Z}$ and $\dfrac{PY}{Z}$, respectively. From the geometry of the figure $\dfrac{X}{Z} = \cos A$, and $\dfrac{Y}{Z} = \sin A$.

If these substitutions are made, each unit length of the diagonal joint is subjected to the following forces:

First:—A horizontal stress of $\frac{1}{2}P \cos A$, and

Second:—A vertical stress of $P \sin A$.

This is indicated in the diagram shown in Fig. 2.

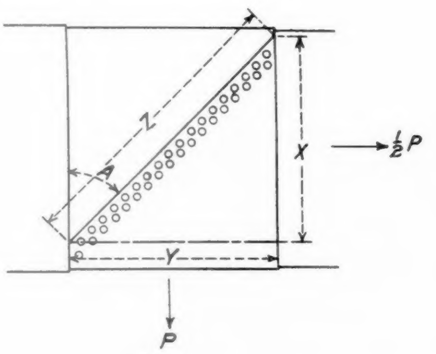


Fig. 1.

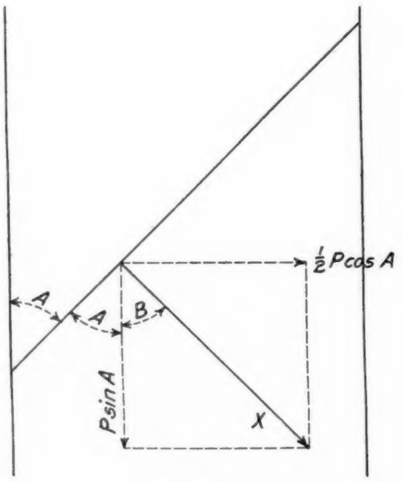


Fig. 2

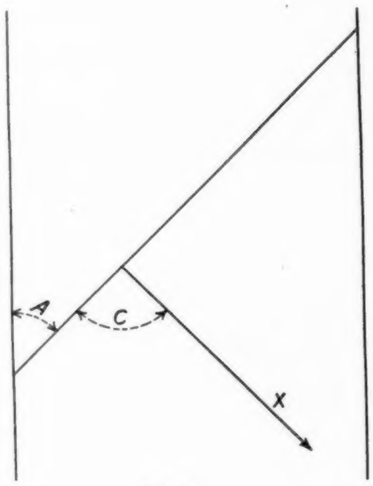


Fig. 3.

Having found how the actual stresses are disposed, several problems present themselves. In the first place, it would be well to know the direction in which the resultant stress X acts. For obtaining this, the diagram, Fig. 2, furnishes:

$$\tan B = (\tfrac{1}{2} P \cos A) \div (P \sin A) = \tfrac{1}{2} \operatorname{cotan} A.$$

If B be found from this equation, then $(A + B)$ is the angle that the resultant force X makes with the diagonal joint. For example, if $A = 60$ deg., $\operatorname{cotan} A = 0.57735$. Therefore, $\tan B = 0.28867$, and $B = 16$ deg. 6 min. Hence: $(A + B) = 60$ deg. $+ 16$ deg. 6 min. $= 76$ deg. 6 min., which is the angle the resultant force acting on the diagonal joint makes with the direction of the joint.

Another problem is to find the force that acts perpendicularly to the direction of the joint—the "normal force," as it may be called. To solve this problem, take the sum of the normal components of the two main forces. The normal component of the horizontal force is found by multiplying that force by $\cos A$; and the normal component of the vertical force is found by multiplying it by $\sin A$. Performing these multiplications and adding the results, the total force that is acting upon each unit length of the joint, and at right angles to it, is found to be:

$$\tfrac{1}{2} P \cos^2 A + P \sin^2 A = \frac{P}{2} (\cos^2 A + 2 \sin^2 A).$$

by a trigonometrical transformation this becomes reduced to:

$$\tfrac{1}{2} P (1 + \sin^2 A),$$

which is the desired expression for that part of the stress which acts perpendicularly to the joint.

In a similar way the component acting parallel to the joint may be found by multiplying by $\sin A$ where we multiplied by $\cos A$ before, and by $\cos A$ where we used $\sin A$. It will not be necessary to give the details of the operation. The result is, that the force acting on the joint parallel to its own direction is:

$$\tfrac{1}{4} P \sin 2A,$$

upon each unit length of the joint.

Finally, the total stress X, which comes upon each unit length of the joint, is to be found. This is made up of the perpendicular and parallel stresses, which have already

been derived, and it acts more or less obliquely—in fact, it has already been found that its direction makes an angle of 76 deg. 6 min. with the joint, in the special case in which the joint makes an angle of 60 deg. with the girth seams. The easiest way to find the total stress X is by adding the squares of the two forces indicated by dotted lines in Fig. 2, and then extracting the square root of the sum. This gives:

$$X = \sqrt{\tfrac{1}{4} P^2 \cos^2 A + P^2 \sin^2 A} = \tfrac{1}{2} P \sqrt{\cos^2 A + 4 \sin^2 A}.$$

TABLE I—FORCE RATIOS FOR DIAGONAL SEAMS

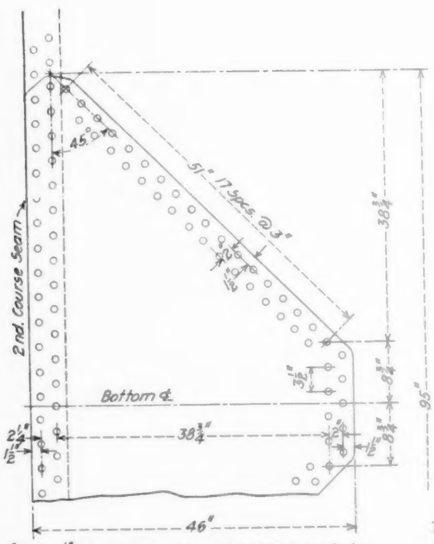
Angle (A) between diagonal joint and girth joint (degrees)	Ratio of force on diagonal seam to that on longitudinal seam	Angle (C) in Fig. 3 (deg. and min.)	Component Force Ratios: Perpendicular to joint	Component Force Ratios: Parallel to joint
(1)	(2)	(3)	(4)	(5)
30	0,662	70 54	0.625	0.216
35	0.705	70 32	0.664	0.235
40	0.748	70 47	0.707	0.246
45	0.790	71 34	0.750	0.250
50	0.830	72 46	0.793	0.246
55	0.868	74 18	0.836	0.235
60	0.902	76 06	0.875	0.216
65	0.930	78 07	0.911	0.192

This may be simplified by noting that $\cos^2 A = 1 - \sin^2 A$. Substituting this in the foregoing equation:

$$X = \tfrac{1}{2} P \sqrt{1 + 3 \sin^2 A},$$

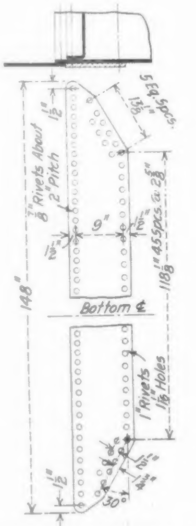
which is the desired expression for the total stress acting upon each unit length of the joint.

These various forces have been calculated by the formulas given above, and are presented in Table I for reference. The unit of force in each case is the force acting upon an imaginary longitudinal joint of the boiler. For example, in a diagonal joint which makes an angle of 35 deg. with the girth joints, the total force acting on a unit length of the actual diagonal joint would be .705 of the force that would be exerted upon a similarly designed longitudinal joint in the same boiler; the force acting perpendicularly to this diagonal joint would be .664 times the force that would be exerted upon a similarly designed longitudinal joint; and the force tending to make the two plates slip in the direction of the length of the joint would be .235 of the total pull that would be exerted girthwise (or perpendicularly) upon a similar longitudinal joint.



1" Rivets-1 1/16" Holes-Shearing Strength 44,000 Lb. Per Sq. In.
5/8" Plate-Tensile Strength 50,000 Lb. Per Sq. In.

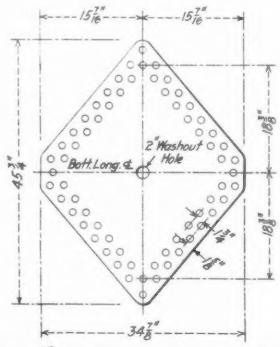
Fig. 4—Patch on Outside of Third Course



Tensile Strength of Plate 50,000 Lb. Per Sq. In.
Shearing Strength of Rivets 44,000 Lb. Per Sq. In.

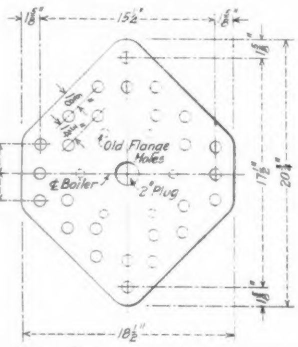
Fig. 5—Patch on Smoke Box

The only remaining problem is to find how the effective strength of a diagonal joint compares with the effective strength of a similar longitudinal joint. Now there is some slight question about how this ought to be done. The strains on the two joints can be compared directly, but the difficulty is to decide whether it would be fairer to count the total force upon the diagonal joint, or only that part of it which acts perpendicularly to the edge of the sheets. The strains are distributed differently from the distribution which holds in ordinary joints, because the force given in the last column is peculiar to the diagonal joint, and does not occur at all in the common forms of joint that are met with in every-day practice. This new force certainly ought to receive some consideration, because it brings a shearing stress on the rivets, although it does not sensibly affect the tensile



1" Rivets-1 1/16" Holes-Shearing Strength 44,000 Lb. Per Sq. In.
3/8" Plate-Tensile Strength 50,000 Lb. Per Sq. In.

Fig. 6—Patch on Bottom of First Course



1" Rivets-1 1/16" Holes-Shearing Strength 44,000 Lb. Per Sq. In.
5/8" Plate-Tensile Strength 50,000 Lb. Per Sq. In.

Fig. 7—Patch on Botton of Smoke Box

strain on the net section of the plate. We shall, therefore, base the estimated effective strength of the joint upon the total stress, as given in the second column of the table; and we shall take the relative effective strengths of a diagonal and a longitudinal joint, as inversely proportional to the total stress to which each is exposed in the boiler.

Now the second column of Table I gives the stress on the diagonal joint as compared with that on a similar longitudinal joint; and hence the effective strength of a longitudinal joint could be found at once by multiplying the strength of the corresponding diagonal joint by the proper number in the table. But this is not precisely what is wanted to be done. The problem should be worked the "other end to"; and hence the effective strength of the diagonal joint is found by dividing the strength of the longitudinal one by the proper number in column 2. Thus in the particular case of a diagonal joint whose angle is 45 deg.; the effective strength of such a joint is found by dividing the strength of the corresponding longitudinal joint by .790; or (which is the same thing) by multiplying it by $1 \div .790 = 1.27$. It will be seen that 1.27 is the multiplier given for this case in Table II; and the other multipliers in that table are all found from the corresponding numbers in the second column of Table I in precisely the same way.

TABLE II—FACTORS FOR COMPUTING DIAGONAL JOINTS

Angle A (deg.)	Factor	Angle A (deg.)	Factor
30	1.51	50	1.20
35	1.42	55	1.15
40	1.34	60	1.11
45	1.27	65	1.08

Table II contains the factors referred to in the foregoing paragraph, and the following rule is used with it:—

"To find the effective efficiency of a diagonal joint, first

find the efficiency in the usual way, as though the joint were of the ordinary longitudinal type. Then measure the angle A in Fig. 1, the angle the diagonal joint makes with the girth joint, and find the factor opposite this angle in the table. Finally, multiply the efficiency as found above by the tabular factor, and the result is the effective efficiency of the diagonal joint."

Example:—Consider a boiler carrying 170 lb. pressure, and having 66 in. inside diameter shell, to which is applied the patch shown in Fig. 4. Figuring the diagonal seam as being in a longitudinal position, the strain on it would equal

$$170 \times 33 \times 51 = 286{,}110 \text{ lb.}$$

Multiplying this by .79 from column 2 in Table I, we have

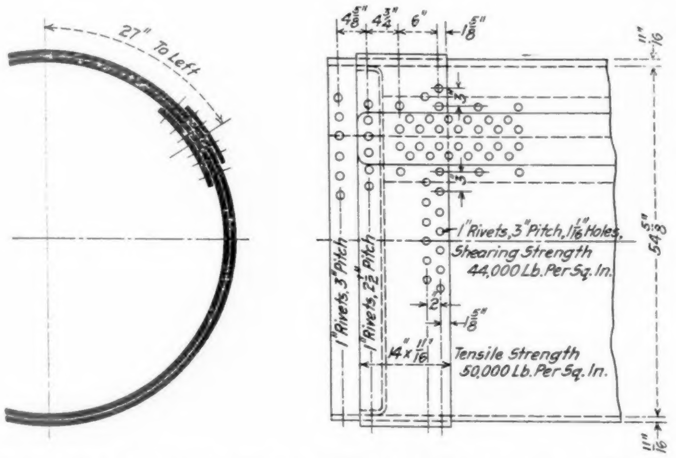


Fig. 8—Patch Around First Course Made on Account of Pitting Around the Tube Sheet

$286{,}110 \times .79 = 226{,}027$ lb. acting on the patch seams. The net section of the plate equals:

$$51 - (17 \times 1\tfrac{1}{16})\ \tfrac{5}{8} = 20.6 \text{ sq. in.}$$

This gives a stress of: $226{,}027 \div 20.6 = 10{,}972$ lb. The area of the rivets is equal to: $33 \times 0.7854 = 25.9$ sq. in. This gives a shear on rivets equal to $226{,}027 \div 25.9 = 8{,}726$ lb.

Likewise the efficiency may be found with the assistance of Table II as follows:

$$\text{Efficiency of plate} = \frac{P-D}{P} = \frac{3-1.06}{3} = .646 \times 1.27 = 82 \text{ per cent.}$$

$$\text{Efficiency of rivets} = \frac{ANS}{PtT} = \frac{.7854 \times 2 \times 44000}{3 \times .625 \times 50000} = 1.35 \times 1.27 = 171 \text{ per cent.}$$

In which P = Pitch of rivets.

D = Diameter of rivet hole.
A = Area of rivet.
N = Number of rivets.
t = Thickness of plate.
S = Shearing strength of rivets.
T = Tensile strength of plate.

Of the two methods the latter is preferable, as it is shorter and allows the designer to compare the efficiency of the patch seam with that of the longitudinal seam. In case the efficiency is equal to or greater than the longitudinal seam the Government alteration report can then be marked "Stresses not changed."

Quoting further from the previous mentioned article, we are advised that "There is still much to be learned about diagonal joints. We need tests of them, made on a large scale, so that we may know exactly how the plates will behave under the oblique stresses to which they are subjected. The only published experimental data that we recall at the present writing are those relating to a test made in England, about twenty-five years ago, by Mr. Kirkaldy. He made up two single-riveted joints of iron plate, .38 in. thick, and having a tensile strength (with the grain) of 39,380 pounds per square inch. One of these was an ordinary square joint with six 13/16-in. rivets, pitched 2 in. from center to center. The other was a similar joint, except that it contained 8 rivets, and was inclined at an angle of 45 deg. to the direction in which the stress was applied. In the tests, the square joint gave an efficiency of 48 per cent., while the diagonal joint gave an effective efficiency of 64 per cent. In other words, the tests showed that the diagonal joint was stronger than the square one in the proportion of 64 to 48; that is, it was 1.33 times as strong. Table II indicates 1.27 as the theoretical ratio in this case. This is as good an agreement as could be expected; but more extensive data would be very acceptable."

Figs. 4, 5, 6 and 7 show patches designed in accordance with the foregoing, in which Figs. 4, 5 and 6 show patches covering pitted portions, while Fig. 7 shows a patch applied on account of cracks around a washout plug hole. Fig. 8 shows a liner applied around the first course of a crown bar boiler, on account of pitting completely around the tube sheet, in which the liner seams duplicate the first cylinder course circumferential seams. Fig. 9 gives instructions for applying throat sheet seams.

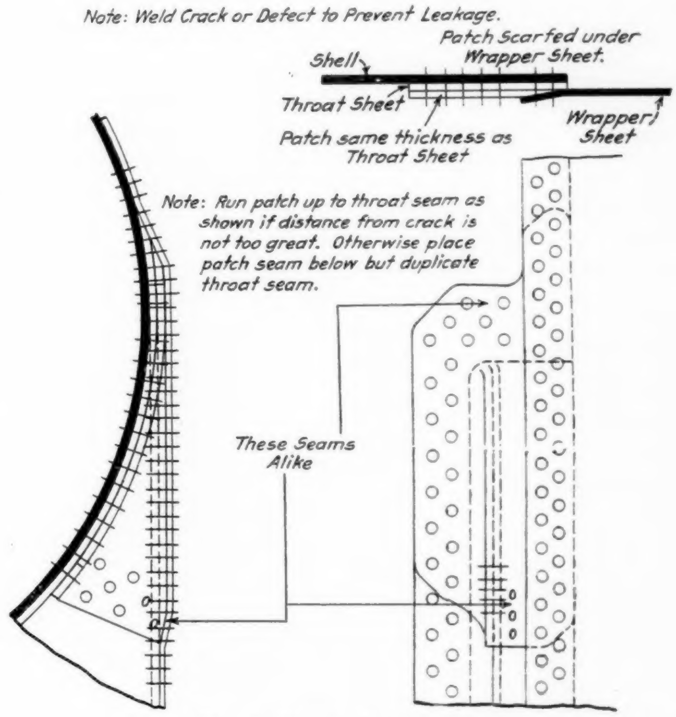


Fig. 9—Throat Sheet Patch

In the application of patches, it will be well to clean out all pits and cracks and fill them by welding, thereby checking the defects from spreading. The patches should be applied on the inside if possible.

For the patch, small cracks that develop while the engine is in service, a patch similar to that shown in Fig. 7 can be designed to be applied with patch bolts, which can later be replaced with rivets when the tubes are renewed.

To save duplication of reports, it is suggested that the badge plate be stamped with the letter R when all of the patches then on the boiler are reported. Future patches would, of course, be handled as they are applied.

Attention might also be called to the fact that some shops are using firebox steel instead of boiler steel for patches,

which practice should be discontinued as the firebox steel is more expensive, besides usually running lower in tensile strength.

The drawing room can work up seams adaptable to various patches on the different classes of locomotives arranged in such a manner as to be perfectly clear to the boilermaker, so that he can apply a patch without having a drawing of the particular patch that he is to apply. This will reduce the work in the drawing room to a large extent.

WORK DISTRIBUTION IN THE ROUNDHOUSE

BY JOHN F. LONG

As an engine arrives at the terminal the usual means of arriving at its condition is the engineman's report, which is made out in a work report book. This is supplemented by the roundhouse inspector's report. The work required by these reports is then copied on slips, one for each job, if the terminal is a large one, or one for each class of work if the terminal is small. These slips should always be dated.

In a large terminal the time of the foreman will be taken up very largely with the purely routine work of seeing that these slips are properly distributed, unless a well organized system for handling them is worked out. The following system is one which serves this purpose successfully.

An oblong box should be located on the foreman's desk, divided into three compartments, one marked "Work," one "Hold" and the third "O. K." When the foreman gets the slips out of the "Work" compartment where the clerk has placed them, he goes over them and decides just what should be done. If he intends to do all the work reported, he or his assistant begins distributing the slips. If, on the other hand, he finds various items which he decides should be done later, he places these in the "Hold" box.

In addition to the box, a board should be provided on which is placed the number of each engine handled at the terminal with a hook under the number. All uncompleted work slips should be distributed on these hooks. For instance, if the traveling engineer or the master mechanic writes in from the line calling attention to certain work that should be done on engine 999, the foreman may receive the letter while the engine is on the road. He then immediately hangs it on the hook under number 999, and should this engine come in, either during the day or night, the report is not so likely to be overlooked as if it were placed in an open file. On the other hand, suppose the foreman desires engine 999 held. He places an order on the hook under 999, specifying the work necessary to be done. If the engine arrives at night, the night foreman knows immediately that it should be placed over the drop pit in readiness for the day men to begin work.

In the roundhouse flat blackboards should be placed near the men's lockers, one for each class of work or gang. These should each have three hooks marked "Work," "Hold" and "O. K." To distribute the work slips they are hung on the "Work" hooks, each group to be taken up by the men assigned to that class of work. If a gang leader is unable to do a certain piece of work to-day, but can get out the material by the time the engine returns from its next trip, he places the slip on his "Hold" hook. By this method a job once reported is never lost sight of until it is finished, and the amount of attention required on the part of the foreman to follow it through is reduced to a minimum.

When a job is completed the man who did the work signs the slip and hangs it on the "O. K." hook, to be collected by the foreman and turned in at the office, where the job is marked "O. K." on the work book, and the slip filed.

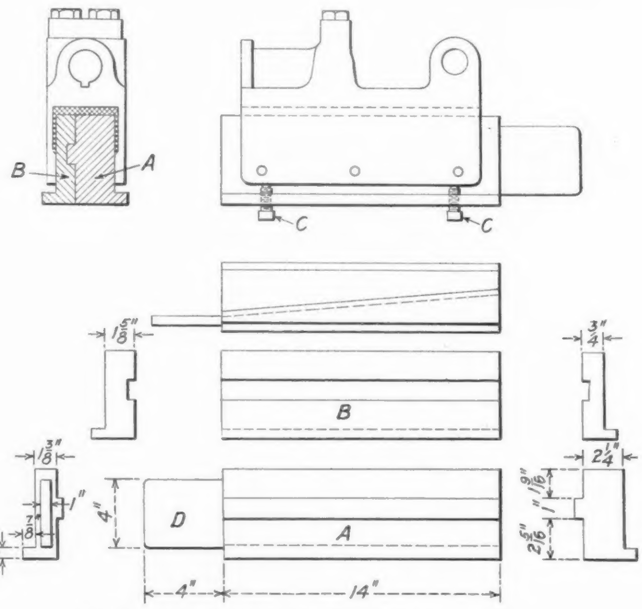
By means of this system the foreman is saved the time which would otherwise be spent in looking for men about the roundhouse when distributing the work slips. Each man or gang foreman, as the case may be, comes to his board whenever he has finished a piece of work and, taking the slips which he finds there, proceeds to the next job. The foreman is thus free to give his attention to his more important duties.

This system also makes it possible to locate the men in the roundhouse when they are needed for hurry-up jobs. As each man takes up a new job he hangs the work slip on the "O. K." hook without signing it. It is evident, therefore, that each unsigned slip on the "O. K." hook of any gang indicates the location of the particular member of that gang.

BABBITTING VALVE ROD CROSSHEADS

BY J. A. JESSON

The device shown in the illustration is used for babbitting valve rod crossheads. With it the surface can be obtained so smooth that machining is unnecessary, and this materially cuts down the labor cost for this work. The device consists of two wedges, *A* and *B*, having a tongue and groove fit. They are adjusted to position in the crosshead by four ad-



Method of Babbitting Valve Rod Crossheads

justing screws, *C*. After the wedges have been set to give the proper clearance, they are driven in tight against the sides of the crosshead. The lug marked *D* is used for separating the wedges after the babbitt has been poured. This device was designed by W. J. Young, machine shop foreman of the Louisville & Nashville at Corbin, Ky.

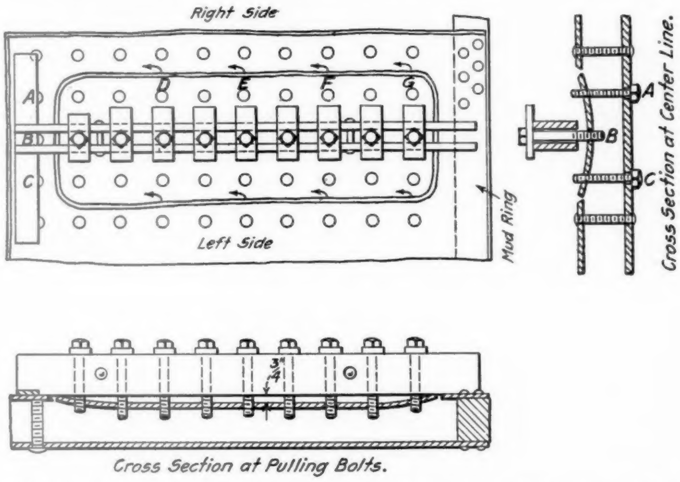
Electric Drive for Battleships Colorado and Washington.—Contracts totaling approximately $2,000,000 have been placed recently with the Westinghouse Electric & Manufacturing Company by the New York Shipbuilding Company for furnishing the necessary electrical equipments for the propulsion of the new super-dreadnaughts Colorado and Washington. The equipments to be furnished are practically of the same design as that contracted for by the Navy Department for the U. S. S. Tennessee now building at the New York navy yard. The four propellers, as in the case of the Tennessee, instead of being mechanically connected to driving engines or turbines, are to be driven by individual motors. The current for the motors will be furnished by two turbine generators.

ASSISTING SHRINKAGE IN AUTOGENOUS WELDING BY MECHANICAL MEANS

BY E. S. NORTON

The greatest difficulties to be overcome in autogenous welding are produced by expansion and contraction and they are especially troublesome in welding locomotive firebox sheets. Welding vertical cracks through several staybolt holes in bad sheets will invariably start trouble in the next parallel row, the cause being checks on the water side that develop and extend when contraction strains are set up at the adjacent row. It is generally supposed that the electric welding process with its small area of heating and limited amount of expansion takes care of all work of this kind. While there is no doubt about its success in a good sheet, it may fail if the sheet is checked on the water side.

In the job which was finally handled as shown in the sketch, a vertical crack was found which extended continuously between nine staybolts. This was electrically welded, and on cooling the next row of parellel bolts showed a crack eight bolts in length. On welding this row the next one cracked for a length of four bolts. The sheet had one



Method of Applying Firebox Patch to Remove Mechanically the Shrinkage Strains

riveted patch, and with this additional trouble, it was slated for the scrap pile. There was only one thing to do: weld in a patch and finish the sheet without leaving any shrinkage strain.

In the sketch, row *A* was the first one welded, *B* the second and *C* the third. These three lines of bolts were cut out and a box patch placed as shown. Rows *A* and *C* were flexible bolts and screwed in position to hold the patch in proper relation to the side sheet. It will be noticed that the patch is dished about ¾ in. towards the water side which allows ⅛ in. for shrinkage when the patch is brought out flush with the sheet. Over row *B* and extending the width of the sheet were placed two parallel bars one inch by four inches, riveted together one inch apart. Between these bars and extending into the holes of row *B* ⅞-in. bolts, supported by straps, were screwed tight. The upper ends of the bars were supported by a plate which extended horizontally along the sheet for a distance equal to about five rows of staybolts; the lower ends were supported by the sheet and mud ring. The sheet was thus protected from a concentration of the load on the bars.

A patch of this kind should not be tacked unless absolutely necessary. The weld was made with oxy-acetylene, beginning at point *D* on the right side and working up to the corner, then dropping to *E* and working up to *D,* and so on, finishing the right side at F. This method of dropping down by eight-inch steps equalizes the strains and keeps the work at a more uniform temperature, as the beginning of each section is made on cold metal and finished on metal which has had time to cool. The left side is welded in the same manner, but as the weld proceeds pull the dish out of the patch with the middle line of bolts. If necesary, the completed weld on the other side should be reheated.

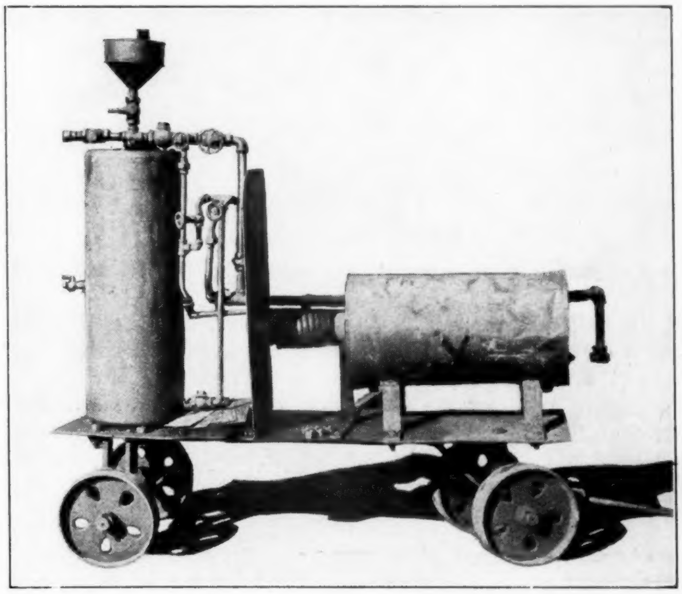
The parallel bars are removed after the vertical welds are completed, and the ends finished. This method of applying the patch leaves the sheet without tensile strain after the weld has been completed.

VAPORIZER FOR BURNING KEROSENE

By CHARLES N. COONS

By means of the device shown in the illustration kerosene is being used very successfully to remove and replace locomotive tires. With suitable burners it can also be used for other classes of heating operations, the flame being much the same as that produced by gasolene.

The equipment is mounted on a small four-wheel truck and can easily be moved from place to place. At the back is placed a reservoir 12 in. by 33 in. On top is shown a hose connection for air and a funnel for applying oil. Standing upright in front of the reservoir is a piece of boiler steel ⅛ in. by 18 in. and two feet high, in front of which is located an oil burner. Beyond the burner is a drum, inside of which is a coil of ¾-in. pipe 10 in. across and 23 in. long. The end of this coil extends through the outer end of the drum and to it the tire hoop is coupled with a union. The oil pipe leads from the bottom of the oil reservoir and is fitted with a ⅜-in. check valve. The air line extends across the top of the reservoir and is fitted with a ¾-in. check valve. Just above the bottom check are two needle valves. One controls the oil to the burner and the other controls the oil to the tire hoop. Above the needle valves are two globe valves, one



Equipment for Vaporizing Kerosene for Heating Tires

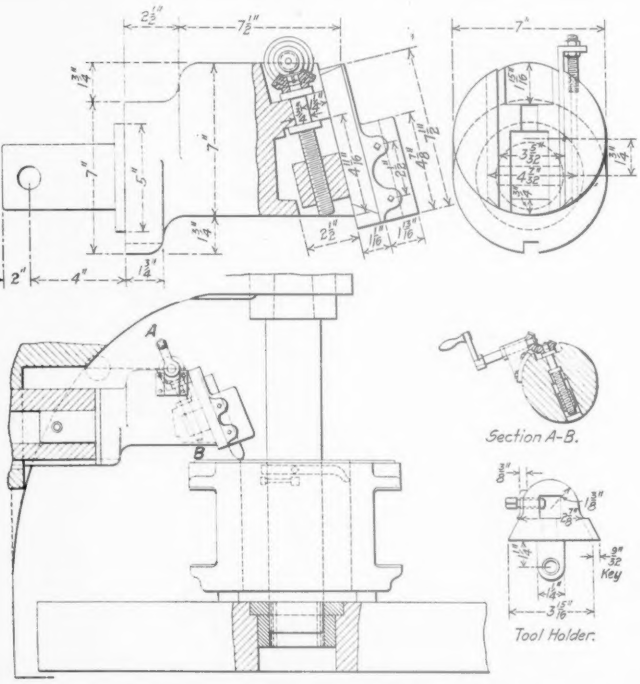
controlling the air to the burner and the other the air to the tire hoop.

When the device is to be placed in operation, the burner is lighted, throwing a steady blue flame into the drum. This heats the vaporizing coil through which the air and oil for the tire hoop passes. The result is a steady blue flame, which entirely encircles the tire, making it possible to remove or replace the tire in the shortest possible time. These machines can be operated by any handy man with perfect safety,

making the cost of operation very low. Four of them are now being used at various points on the Illinois Cenrtal.

NOVEL USE FOR CAR WHEEL BORER

It is seldom that a tool designed especially for work on one particular part is well adapted to operations on other parts. A car wheel borer was, however, converted into a very efficient machine for boring and facing driving boxes by the addition of the devices shown in the illustrations below. The general arrangement of the borer with the special appliances and some of the details of the special head for the facing bar are shown in the illustration. The center of the table was bored to receive a brass bushing, and a special boring bar extending into the bushing was provided. It was also necessary to design a special head for the facing bar to give sufficient clearance between the table and the facing tool. The offset head was forged from mild steel and accurately fitted to the cross bar. In the end of the head a tapering slot was machined to take the tool holder. The vertical adjustment



Car Wheel Borer, Arranged for Machining Driving Boxes

of the tool was secured by a screw controlled by bevel gears and a handle carried in a bracket on the head. The tool was held in the slot by two set screws. As the special head brought the cutting point of the facing tool closer to the axis of the bar than the original arrangement, the rigidity of the bar was not impaired. The boring bar, supported by the bushing in the table, was very rigid and the results obtained with the machine were highly satisfactory.

Cutting Steel with Oxygen.—The following examples of good average cutting are from experiments with a hand oxygen cutter, which was only altered as required for the gas pressure corresponding to the thickness of plates:

Thickness of plate. Mild Steel.	Metal cut per hour.	Oxygen consumed per hour.	Pressure of Oxygen (atmospheres).
½ in.	60 ft.	60 cu. ft.	2
1 in.	40 ft.	90 cu. ft.	2.5
1½ in.	30 ft.	105 cu. ft.	3
2 in.	25 ft.	120 cu. ft.	3.5

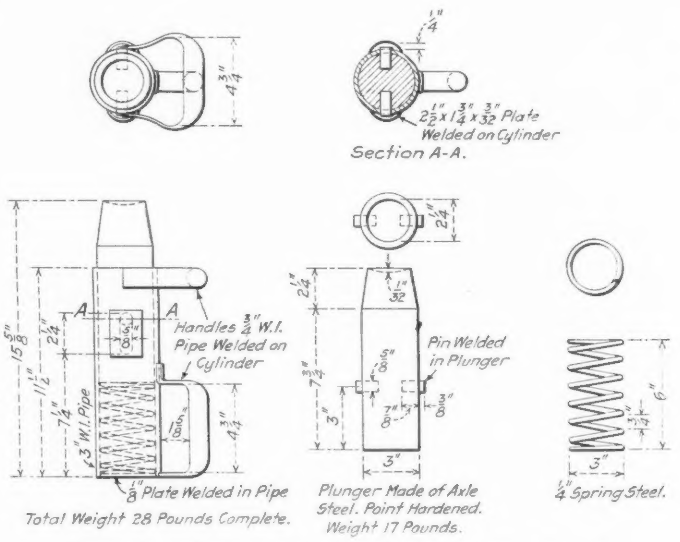
The oxygen hand-cutter has been found valuable and economical in cutting up all kinds of steel work.—*Institution of Mechanical Engineers.*

STAYBOLT HOLDER-ON WITH AUTOMATIC RECOIL

BY PERRY J. SWEZEY

When a sledge or solid bar is used for holding on staybolts when riveting them with a pneumatic hammer, the hammer strikes so fast that the holder-on cannot keep his sledge or bar up to the head of the bolt to receive all of the blows that the hammer delivers. At least 35 per cent of the blows are not only useless but a detriment to the boiler.

With the tool shown in the sketch an experienced man can hold on staybolts just as long as the man with the hammer



Staybolt Holder-On for Use with Pneumatic Hammer

wants to drive. It eliminates the constant jar of the ordinary bar, thereby making it easier for the operator, and is always back on the staybolt ready to receive every blow from the hammer, thereby increasing the efficiency of the pneumatic hammer. The piston bar weighs 17 lb. and rests on a 6-in. coil spring of ¼-in. spring steel. Both are enclosed in a casing of 3-in. pipe 11½ in. long which is closed at the bottom with a ⅛-in plate welded in place. On opposite sides of this cylinder, 7¼ in. from the bottom, are cut two slots ⅝ in. wide and 2¼ in. long. These serve as guides for ⅝-in. pins welded in the plunger, and are closed by dished patches of 3/32 in. plate welded on the outside of the pipe after the parts are assembled. The plunger is thus always kept in the casing, in which it has a maximum movement of 1⅞ in. The device is provided with convenient handles of ¾-in. pipe welded to the casing.

The tool complete weights 28 lb. and is operated in the same manner as an ordinary bar, except that the piston bar inside of the casing must be held down on the spring about one inch to get the desired result. The plunger will then recoil as fast as the pneumatic hammer strikes.

Anyone who is familiar with the operation of driving staybolts with a pneumatic hammer can readily see the improvement which will result from the use of this tool.

Loss of Head Due to Bends in Pipe.—The loss of head due to curves and fittings is usually stated in terms of the equivalent length of straight pipe of the same size that would cause the same or equal loss. Experiments show the radius of minimum resistance for right-angle curves to be from 2 to 3 diameters of the pipe. For 6-in. water pipe the minimum loss is about the same as 8 ft. of straight pipe, and for 30-in. pipe about 40 ft. of straight pipe. Intermediate sizes vary between these limits approximately as their diameters.—*Power.*

"CLEANING UP" MUNCIE ROUNDHOUSE

Rebuilding a Demoralized Organization; How Tom Carleton Handled His Foremen and the "Old Man"

BY HARVEY DE WITT WOLCOMB

"AND now just one word of caution," said Mr. Andrews, the master mechanic, as he sat in his office, holding his first conference with Tom Carleton, the newly appointed general foreman at Muncie. "You are probably aware of the fact that many men imagine it necessary to fire every last man about the plant—I believe you call it 'cleaning house'—but I do not like those tactics and feel that your success should be measured by the good work you can secure from our present force, therefore I wish to caution you not to take any hasty action. Before you make any decisive move, just stop and think that perhaps the very man you want to discharge has worked for us a long time, and that he knows his business very well although he may have become lax. By taking a little interest in his case, you may be able to straighten him out so that he will do much better than a new man would."

"All right, Mr. Andrews," replied Tom, "but if after going thoroughly into a case, I find there are no good grounds on which to re-construct, I trust you will stand with me in every decision I make."

"If it becomes necessary to go that far," continued Mr. Andrews, "we will look into the case and advise you whatever action you may take."

"But can't you see I am here to run this place?" quickly spoke up Tom. "And believe me, I intend to run it first, last and all the time. If I have to take up every little thing with your office, you will have me writing letters all the time; therefore my methods will be to get results first, and then confer with you afterwards. Mr. Andrews, I am in the habit of doing things, not just talking about them, so leave it to me till I have fallen down on something and then we will arbitrate," lamely added Tom, for he saw that he had made a grave mistake by showing his temper at the very first conference with the master mechanic.

He got away from the conference as soon as he could and arrived at his office in anything but a pleasant frame of mind. For, aside from the fact that he thought he had made a fool of himself, he had discovered at the very outset that instead of being permitted to do all the big things he had planned, the management intended to tie his hands so that in reality he would be simply a "go between." If he wanted to call a man down, it would be necessary to first talk the matter over with the higher officers, for sometimes a man won't stand the "gaff" of a genuine "call down" but will talk right back so that the upshot is that one or the other of the parties must quit. After the talk he had just had with the master mechanic he realized that there probably would be some unpleasant questions asked if any one of his men should resign. Tom could see that he was in a tight place. Knowing the nature of railroad men in general, he had made up his mind to whip his force into shape by holding that dreaded demon "discharge" over their heads, for he knew that many good men who are slow to anger, will take a "call down" to heart so seriously that they will resign; but talk "discharge" to them and they are soon persuaded to do what is expected of them. Well, there was no use of locking the barn after the horses had been stolen, so he thought he might as well get on the job and do the best he could. Tom's strongest argument in the past had been that no man can tell what he can do until he has tried, so he might as well try some of his own medicine.

In taking up his mail, he could not help noticing the sharp contrast between the light and clean office of the master mechanic and the dingy hole he had to call his headquarters. As he would probably spend his best hours in this very office, why should he not have the place fixed up a bit. In the master mechanic's office there was a clean wash bowl with hot and cold running water; in his own office there was an old bucket always about half full of dirty water. The windows were very dirty and the paint was almost black with soot. Many spots showed where men had come in and leaned up against the walls. In order to make a start in fitting up his office so that it would resemble the abode of a human being he sent for his paint shop foreman, intending to have him wash out the place and then give it a fresh coat of paint; but he was very much surprised and irritated to have that worthy person inform him there were no men he could spare just then to put on the job. Though disappointed in not being able to have the work started at once, Tom said nothing more about the matter to the foreman.

On going out in the roundhouse, he noticed several steam leaks in the overhead pipes, and as a steam leak always appealed to Tom as a needless waste of money, he sent for his pipe shop foreman intending to have the matter given immediate attention. Again he was to receive a shock, for the pipe foreman readily admitted that he had known for some time about those leaks but had been unable to get around to them because his men were so busy. Now to any man but Tom this might have sounded all right, but he had noticed during the past few days, that there weren't many men around the house, yet there were just as many carried on the pay roll as before. Tom, being a past master in the in's and out's of roundhouse work, surmised where the men were, and decided to teach his foremen a good lesson at the first opportunity. This opportunity soon held out both hands to him. His ash pit foreman came up and asked for more men, saying that he was tied up on the pits.

"Will twenty good strong men for the balance of the day help you catch up with your work?" asked Tom. "They certainly would," replied the ash pit boss, feeling elated at having "slipped something over" on the new boss.

"All right," replied Tom, "come with me and I will get you the men." Starting for the turntable pit, they turned at right angles when they reached the doors of the house and then going around three or four pits, Tom turned in between two engines and came back toward the outside of the house. In the very first cab to which they came, they found a good husky workman sitting on the fireman's seat, smoking his pipe. When he spied Tom looking up at him through the gangway he acted as if he wanted to swallow pipe, tobacco and all. But it was too late, for he was caught fair and square, and there was nothing to do but obey when Tom said curtly, "Report at my office at once; I have a special job for you. If I am not there when you get there, remain till I come."

Before reaching the next engine, the ash pit foreman volunteered the information that the fellow whom they had just sent to the office was the best pipe fitter at Muncie, but as Tom did not seem to be in a mood for conversation there was no further talk. In the next cab they dug out three workmen, and, after directing them to report to his office, Tom continued on the way through the house till he had secured the twentieth man. Then turning to the ash pit foreman whose face showed his astonishment at what was going on, Tom

asked if that would be enough men. Receiving an affirmative answer, they both started for the office. On coming up to the gang there assembled, Tom said simply, "Men, the ash pit boss is short of help today, and as none of you fellows are working, I guess we can spare you to help us out on the pit for the balance of the day."

Now the very first man whom Tom had kicked out of a cab was the leader of the local grievance committee. He immediately assumed the dignity fitting one of his exalted position by making a protest against any such action, saying that he was a pipe fitter, not an ash shoveller. "Thanks awfully for telling me," said Tom, "for from what I saw you doing, I did not know whether you was a good pipe fitter or a good ash shoveller. You have first to prove to me that you are a good ash pit man before I will believe you are a good pipe fitter. You can go with these men or get off the place." There was no argument against this statement. The men, sensing the weakness of their position and the determination of the new foreman, followed the ash pit boss out of the roundhouse.

Tom knew what to expect from the foremen and he went into his office to await developments.

The boiler foreman, with blood in his eye, was the first one to come in; then the pipe shop foreman came along, and soon most of the foremen about the place were there. As each man came into the office, Tom told him to wait a few minutes, as he wished to take up some important matters with them. The foremen noticing that apparently all were there thought that the new general foreman was going to hold a staff meeting, so they made themselves comfortable. It had been the custom to hold occasional staff meetings of the foremen, which usually settled into discussions among two or three foremen, while the other men either slept or drew pictures on the backs of their work order pads.

Tom's predecessor had been a vain, self-conscious mechanic who thought himself a very wise man. His foremen had early discovered that they could handle him as they pleased by the judicious use of flattery. In fact, the boiler shop foreman made his open brags that the boss did not know anything about boilers and could be made to agree to anything, so that he had everything his own way. Other foremen had developed their own methods of handling the boss, and all in all, there was a general feeling about the place that a general foreman was a joke. Right here, however, they were to wake up to the fact that they had a real man to deal with and that they would have to play ball or get off the team.

As soon as everyone was settled, Tom said, "Gentlemen, this is evidently some kind of a meeting which is a surprise to me but as you are all here, I wish to say that the next time I catch another workman up in a cab loafing or smoking, I will discharge his foreman. I have noticed for some time, the scarcity of men about the place but when I look in the cabs, it does not take very long to find 20 extra men. I have taken the first twenty I came to and put them to work on the ash pit for the balance of the day, where they will earn, at least, a little of their pay. From now on, I will depend on you gentlemen to see that your men are on the job all the time. If they do not have any work, tell them to remain at the work benches so that we can see if we have any great surplus of workmen."

The boiler shop foreman spoke up: "But Mr. Carleton, it is not the policy of this company to discharge its foremen without first taking the matter up with the higher authorities."

Tom inwardly groaned, for he could see the influence of the policy established by the master mechanic, supposedly in the interest of a square deal. He could see how his predecessor had lost all hold on the men by working constantly in fear of making a wrong move. There isn't a man living who does not hate to back up after he has once taken a decisive stand. With Tom it was a horse of another color for he had always been trained to act first and then to receive the support of his master mechanic, who had always placed the greatest confidence in him. Well, if he wasn't going to be able to handle this job he might as well find it out now as later, so squaring his jaw he came right back at the foremen. "Let me tell you one thing right now," said he. "It is the policy of this company to get its work done, and I am here to see that it is done. That is the only policy I am interested in. If any one of you came here to question me about taking your men and sending them out to the ash pit, I believe you have been sufficiently answered. Now, I guess you can get on your jobs."

The next morning, Tom's office was being cleaned out preparatory to receiving a coat of paint, and the steam leaks were fast disappearing all over the house. Besides, the place seemed to be full of workmen.

Shortly after this, as Tom sat in his office looking over his mail, he was annoyed by the humming of a pop on an engine just outside his office. Now Tom, like every other mechanic, really enjoyed the many noises that are always present in a busy roundhouse, but the pop on the engine outside his office was a discordant note because he realized that it was caused by a leaky valve. On going out of his office, he came across the man who looked after cab work and asked him what was the matter with the pop valve on this particular engine. "Oh, that pop leaks a little, I guess," replied the mechanic, "but not enough to hurt anything, for the inspectors haven't reported it yet, and I guess what is good enough for them is good enough for the old N. & O."

This remark "got Tom's goat," for of all the things he detested, it was the excuse of a half-rate mechanic for a poor job. In his mind there were just two ways of doing a job—the right way or no way at all—so he waded into that machinist in a manner both forcible and instructive. "Why, man alive," said Tom, "don't you know or realize that every report turned in by an inspector is simply a reflection on your ability and good judgment as a mechanic? Don't you know, or pretend to know as much about your trade as one of the inspectors? This engine was repaired only a few days ago and now you tell me that you are waiting for some inspector to condemn your work before you will make it right. Haven't you any pride in your work? I have as much pride in my calling as any other professional man and you should too. Now will you see that that pop is fixed or will it be necessary for me to get it done myself?"

This machinist was a good workman but had fallen in with the slip-shod methods generally prevailing at Muncie. Tom's reproaches made him very much ashamed of himself. "Mr. Carleton," he said, "I am considered a first class machinist and am proud of it. From now on you needn't worry about the quality of my work."

Instantly Tom shook hands with the man, saying, "With that spirit your success, my success and the success of the N. & O. is assured."

[illegible] Tom had been on his new job long, he discovered th[illegible]e weakest point in the facilities of the terminal was the machine shop, which was suffering from a lack of sufficient machine tools. He knew it would be a waste of time to simply suggest what he wanted, so he dug into the matter with his usual thoroughness, making a careful study of the whole situation. In talking the matter over with his machine shop foreman, he was surprised to learn that it was the general practice about the terminal to order just twice as much as any one needed, for it was the custom of the master mechanic to cut all requisitions in half. Tom did not like this method of doing business, and as he was serious about what he wanted, he carefully made up his list of new equipment, feeling that if the master mechanic could talk him out of any of the machines he had on his list, he would have to acknowledge a fair and just defeat. Completing his

list, he went over to the office to have it out with the "Old Man."

Now the master mechanic really knew that the machinery at Muncie was out of date, but like many other officers, he thought he was making a record by not spending any money for new equipment and that the old tools would do so long as they held together. He felt that so long as the shop forces could get along with the old equipment, there was no use of spending money for new and he had "bluffed" every man who had ever made a request for new equipment. But with Tom on the job, he was up against a different proposition. Tom knew what he wanted first, then he developed and tested his arguments so well that the "Old Man" soon realized he had bumped up against a fellow who could not be put off with the old plea of economy. As there was no use in argument, the master mechanic promised he would have a special man from his office look into the matter and make a report with recommendations. Instantly Tom "went up in the air" for all the time and attention he had just given to the subject apparently was wasted. The chances were that the fellow who would be sent down to make the investigation would be some man with no actual experience in roundhouse machine shop requirements, and Tom did not feel like spending any more of his valuable time on the education of such an individual. With these thoughts running in his mind, Tom asked the master mechanic if he did not think that the general foreman had the ability to select such machinery as was required in his own shop.

"Oh yes," he replied, "I have all the confidence in the world in you, but the regular routine in a matter of this kind is to have one of the young men out of my office make the investigation and recommendations for new machinery. Besides I have a new fellow here who is just out of college, who claims to have made a special study of machinery requirements, and I would like to try him out to see what is in him. You must certainly agree with me that everybody should have their chance." Tom could see that it was useless to argue the matter further for he was up against regular routine and a pet hobby of the "Old Man's," so he reluctantly gave up for the time being, but resolved that he wasn't through yet. There surely must be some way whereby he could secure what he needed.

There are several types of men in the railroad world who seem to get along well with their work, yet no two of them go about their duties in the same way. Tom never "cussed" anybody, nor did he drive his men unmercifully, yet he seemed to get results. The men were right up on their toes all the time, although no one ever complained about how hard he was working. Tom always said that if you were first sure that you were right, no man would hesitate to do as requested. He always put a lot of thought on his problems, and wasn't satisfied until he had found a solution that was simple enough to be practicable.

Accordingly during the days following his request for the new machinery, Tom did some pretty tall thinking. One day a thought struck him like an inspiration [illegible]e smiled all over. He immediately laid his plans to get the best of the "Old Man." The master mechanic at Muncie, like many other good railroad men, had overtaxed his physical and nervous strength while a young man with the result that now in middle life, he was not in rugged health. He frequently had to call on the doctor in order to keep up and at his duties. So Tom waited until he knew that the "Old Man" was feeling pretty bad and then he went in the office to see him.

On entering the master mechanic's office, he said he had come over to talk about some special business, but first wanted to take up some important matters concerning a couple of engines then in the roundhouse. After this business had been settled Tom leaned back in his chair and remarked that he did not look very well that morning. Mr. Andrews admitted he was not feeling very well, but thought his doctor would soon fix him up.

"By the way, Mr. Andrews," said Tom, "I have a young friend just out of college who has made a special study of the human body and I would like to have him tackle your case so that we can see just what is in him. You must agree with me that everybody should have their chance."

The "Old Man" looked at Tom as if he wanted to eat him, but as Tom returned his gaze in a straightforward manner, he decided that there was nothing personal in Tom's remarks. It didn't set very well, though, to be asked to offer himself as a sacrifice for some cub of a doctor to practice on. Tom did not give him time to frame a reply, however, before he continued: "Mr. Andrews, plug your heart and you die; plug your machine shop and your roundhouse dies. You did not hesitate to tell me that you would let some young man experiment with the main artery of my work, to give him a chance, yet you are offended even at the thought of placing yourself in the hands of an inexperienced young doctor. I know what my machine shop requirements are. I am the doctor who has had the long experience, therefore can prescribe just the remedy needed to keep my patient alive and healthy. Here is the prescription I would like to have filled." So saying, Tom handed the master mechanic the same list of machine tools the master mechanic had refused to consider a few days before.

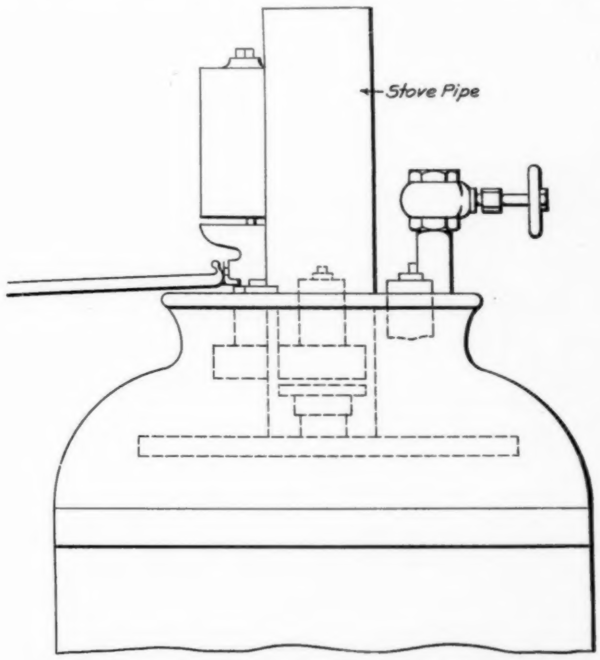
The boss was beaten and he knew it. He didn't try to beat around the bush any longer. Calling in his chief clerk, he gave orders for the placing of requisitions to cover the list of tools.

Some new machine tools are now arriving at the Muncie roundhouse and the men are wondering why the master mechanic has taken to calling their general foreman "doctor."

LOCATING DEFECTIVE SAFETY VALVES

BY F. W. BENTLEY, JR.

Due to the close grouping of safety valve sets on many types of locomotives, together with the surrounding arrangements of dome casings and other attachments, it is sometimes a difficult proposition to locate a leaky valve. The one giving the trouble generally fills the casing with steam and at night it is often an impossibility for machinist or engineer to locate the defective valve without raising the



Method of Locating Defective Safety Valves

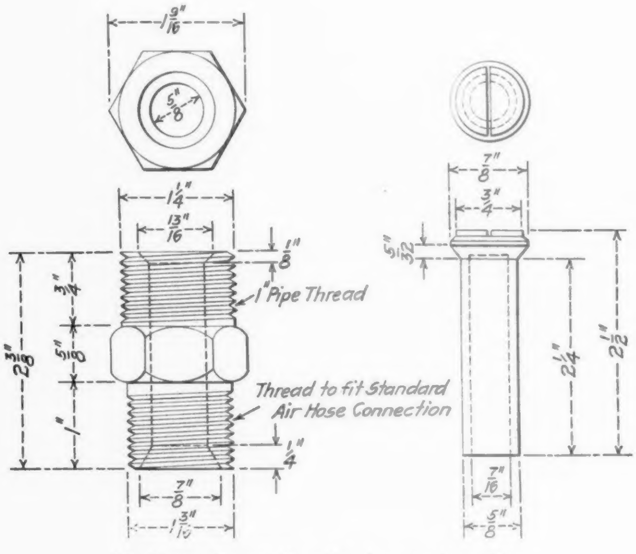
casing. The arrangement of other parts on the dome frequently prevents this until the engine is cooled down.

A very simple method of quickly ascertaining defective valves is shown in the illustration. It consists of a common stove pipe which can be dropped down into the casing and over the valves. When it is placed over the leaking valve the steam will be carried clear of the casing through the pipe. Where the casing cannot be removed and the work is hampered by lack of light and weather conditions, the above method is a very practical way of quickly finding the bad order valve as well as eliminating the results of what is sometimes a bad guess.

AIR HOSE CONNECTION FOR PITS

BY R. L. PRESTON

The air hose connection shown in the drawing is used in the place of valves in the pit air line. It consists simply of a check valve, having a ground seat in the cage which fits into the air line. As the hose is screwed on to the valve cage, the cone-shaped end of the air hose connection, raises the valve from its seat, allowing the air to flow through the pipe. Previous to the adoption of this type of check valve, considerable trouble was experienced with the cut-off cock being broken off or getting out of order while working about the pit. This arrangement causes no trouble and prevents the loss of air due to broken valves. The stem of the valve is ⅝ in. in diameter, filed or ground down to a thickness of 7/16 in. on two sides as shown in the illustration.

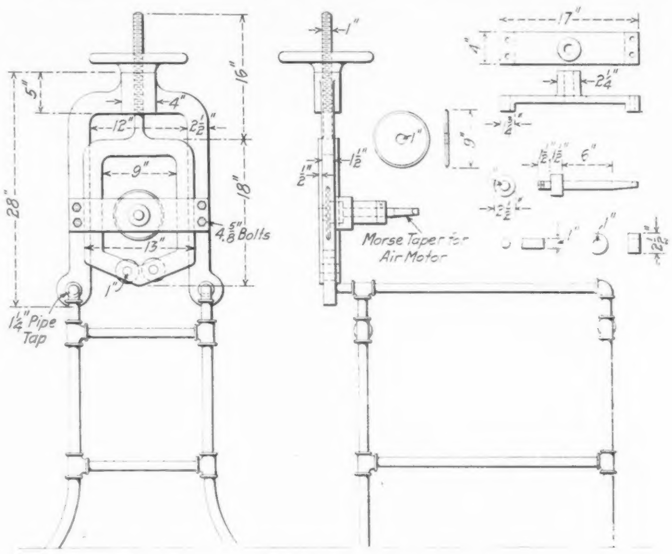


Air Hose Connection for Locomotive Pits

PORTABLE FLUE CUTTER

BY W. S. WHITFORD

The portable flue cutter shown in the illustration has been found to be a serviceable tool, especially in an enginehouse where on account of the three-year limit for locomotive tubes set by law, it is often necessary to renew some of the tubes. The body, or upper part of the machine is forged from a piece of soft steel 2½ in. wide and 1½ in. thick. In the center at the top a boss 4 in. in diameter receives the threaded stem of a yoke which carries at the bottom two 2½-in. cutters. This yoke is free to slide up and down in the frame and is controlled by the handwheel as indicated in the drawing. Between the legs of the main frame extends a bearing for the large cutter which is 9 in. in diameter. This cutter is mounted on a shaft having a Morse taper shank on which is placed an air motor. This remains in a fixed position. To cut a tube, the yoke is lowered for the tube to be inserted between the two small cutters and the large cutter, and it is then raised until all three cutters bear on the tube. The large cutter will travel at a high velocity and as the yoke is raised, the tubes are easily cut. It will be seen that this machine will easily handle a superheater flue. The whole device is mounted on a framework made of 1¼-in. pipe.

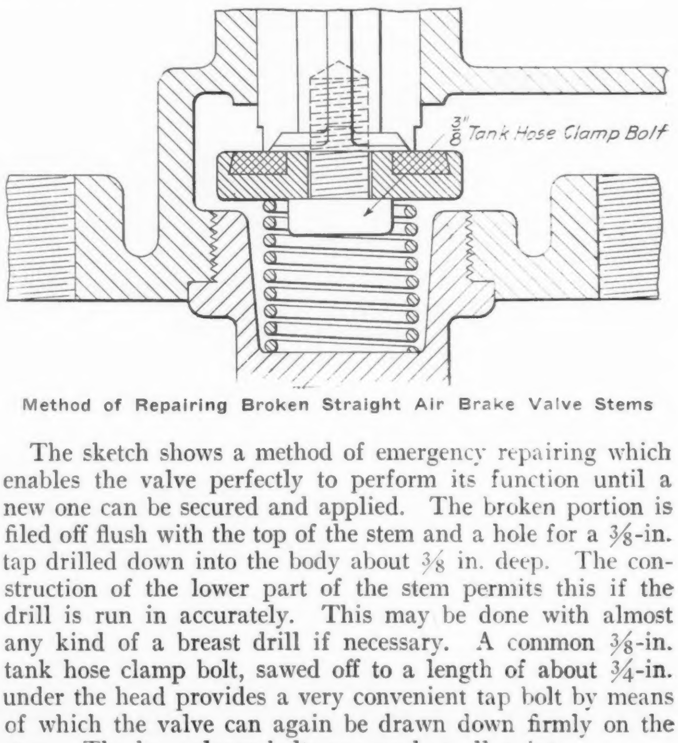


Portable Flue Cutter for Engine Houses

EMERGENCY REPAIRS TO STRAIGHT AIR BRAKE VALVE

BY F. W. BENTLEY, JR.

The upper or thread portions of the air valves of the Westinghouse S-3 brake valve sometimes break off when the leather disk holder is drawn down into place on the stem. As the threaded portion is a part of the stem itself, the stem is rendered useless when it gives way. As such breakages do not often occur, stems are seldom carried in stock.



Method of Repairing Broken Straight Air Brake Valve Stems

The sketch shows a method of emergency repairing which enables the valve perfectly to perform its function until a new one can be secured and applied. The broken portion is filed off flush with the top of the stem and a hole for a ⅜-in. tap drilled down into the body about ⅜ in. deep. The construction of the lower part of the stem permits this if the drill is run in accurately. This may be done with almost any kind of a breast drill if necessary. A common ⅜-in. tank hose clamp bolt, sawed off to a length of about ¾-in. under the head provides a very convenient tap bolt by means of which the valve can again be drawn down firmly on the stem. The hose clamp bolts are used at all points.

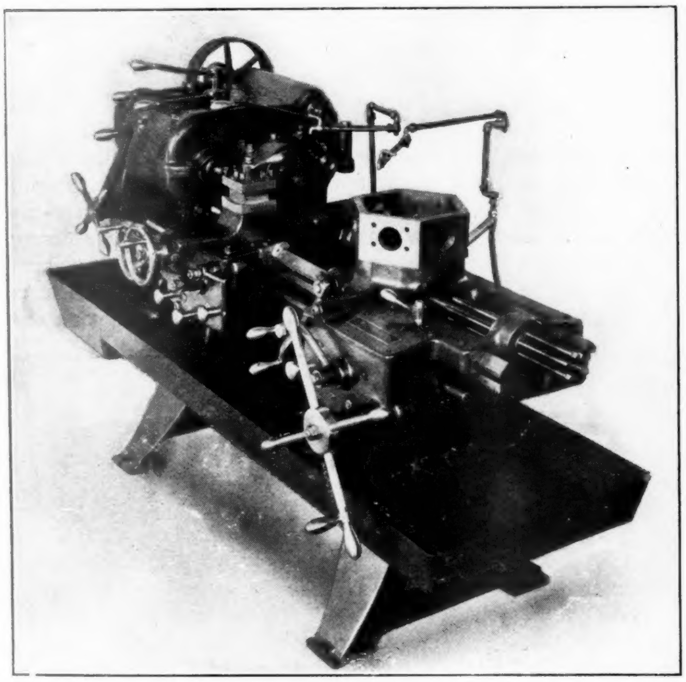
New Devices

FOSTER UNIVERSAL TURRET LATHE

The wide range of work for which turret lathes adapted to both chucking and bar work can be used makes such tools particularly useful in railroad shops. A mahcine of this character, called the type 1-B universal turret lathe, has recently been placed on the market by the Foster Machine Company, Beardsley avenue and Ward street, Elkhart, Ind.

The machine is of the geared-head type with a hollow hexagon turret on the longitudinal slide and a square turret on the cross slide. It has a hole 2⅜ in. in diameter through the spindle, and will handle 2 in. round or 1⅜ in. square bars. The swing over the cross slide is 8 in., over the carriage guides 14 in., and over the bed 15½ in. The longitudinal travel of the carriage is 20 in. and the cross travel of the cross slide 10 in. The latter is fitted with screw cutting and taper attachments. For bar work it is equipped with a draw-back automatic chuck and for chucking work, with a three-jaw geared scroll chuck.

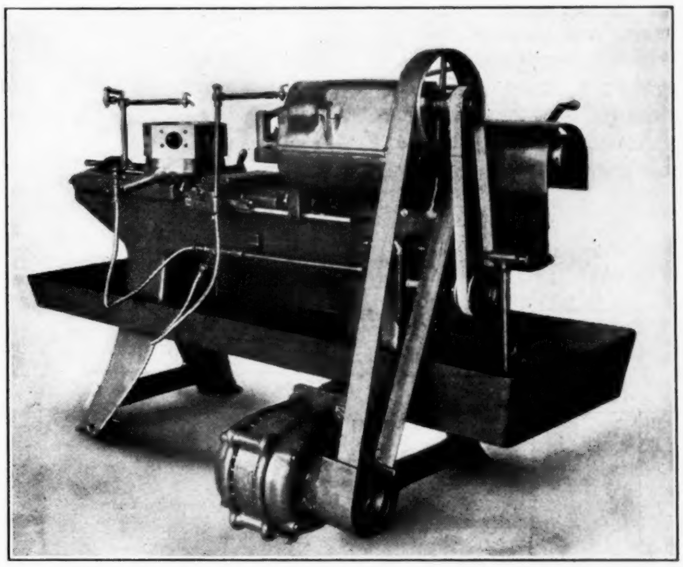
The head and the bed are cast integral. The bed is short and heavily ribbed with carriage ways of the V-type, having a large bearing area. The head is of the geared type, being



Foster Type 1-B Universal Turret Lathe for Bar and Chucking Work

driven by a single pulley, the shaft of which is mounted in phosphor bronze boxes. Twelve speed changes are obtained in either direction, by sliding gears controlled by levers mounted on the top of the head casing. All gears are heat treated and hardened. They are of the stub tooth form, which gives strength and quiet operation. The gears in the head run in a bath of oil. The friction clutch is designed to transmit power in excess of the greatest amount that can be delivered by the belt.

The spindle is made from a high carbon machine steel forging and runs in extra long bronze boxes. There are twelve spindle speeds ranging from 20 to 480 r.p.m., which makes it possible to secure the proper cutting speed for all classes of material within the limits of the size of work the machine will handle. The gear box on the end of the head contains the gears through which the feed rod for the tools is driven, and also carries part of the mechanism of the automatic chuck for the bar feed. The feeds for the cross slide vary from .0016 in. to 0.1 in. per revolution of the spindle.



Rear View of Foster Universal Turret Lathe

The change mechanism is located partly in the gear box and partly in the apron. The gears controlling the changes and the driving pinion which engages with the rack on the bed are of heat treated chrome-nickel steel. The drive from the feed rod is through a worm and gear and the reverse and change gears are controlled by plungers. On the apron is a revolving spool which carries six screw stops. When one of these comes in contact with the adjustable stop rod it causes a longitudinal movement of the spool, which releases a catch and causes the horizontal lever to drop and thus releases the feed friction. The friction release for the cross movement is hand-operated.

To provide for duplicating diameters there is a dial of large diameter on the front end of the cross feed screw. A number of clips mounted on the dial indicate the setting for the sizes which are to be duplicated. A square turret designed for holding ½ in. by 1 in. forged tools is mounted on the cross slide. Provision is made for mounting special tools, such as forming tools too wide to be mounted in the square turret, on the rear of the cross slide. A special mechanism on the cross slide makes it possible to withdraw the tool between cuts and then reset it and feed forward for the next cut. This is particularly useful when cutting threads. A handle on the carriage clamps it to the bed when desired.

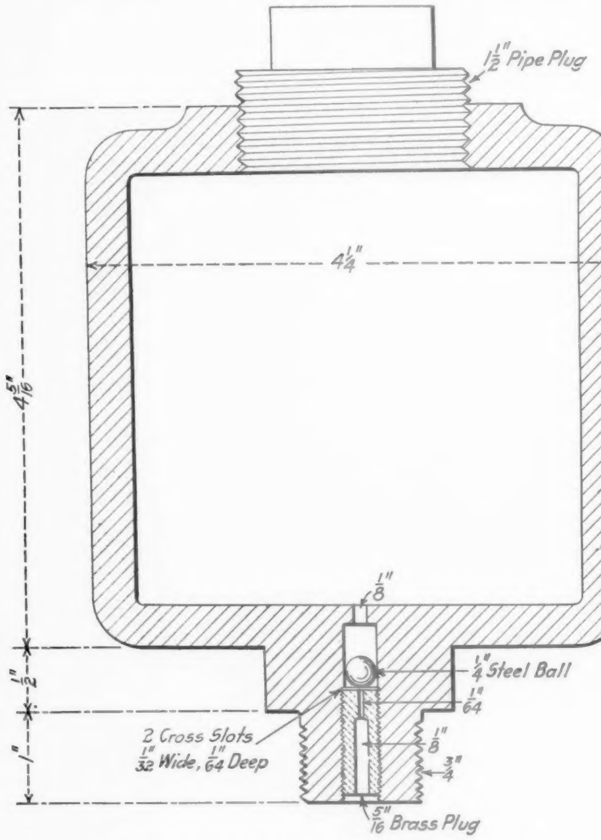
The turret on the longitudinal slide is of the hollow hexa-

gon type with a large bearing surface on the saddle. One lever controls the lock bolt and the binding mechanism for the turret, and when it is moved the turret may be indexed by hand. The stop screws, seven in number, are held in a spool, on the saddle and geared to the parts and thus index with it. The feed stop is similar in design to that on the saddle apron. The feed changes provided are also the same as on the cross slide. The pump for the cooling compound is mounted on the rear side of gear box, and is driven by a belt from the main pulley shaft. A system of piping and flexible tubes carries the liquid to each tool. This piping can be arranged for oil tube drills or similar tools if desired.

The turret lathe is regularly equipped with overhead countershaft but is also arranged to be driven by a 5 h.p. motor running at about 1200 r.p.m., mounted on the rear of the front leg. An extensive equipment of tools and attachments can be furnished with the machine.

AUTOMATIC DRY GRAPHITE CYLINDER LUBRICATOR

An automatic graphite lubricator for locomotive cylinders which has been tested in service over a period of about two years, has recently been placed on the market by the United States Graphite Company, Saginaw, Mich. It uses fine powdered amorphous graphite, 98 per cent of which will pass through a 300 mesh screen. The graphite not only acts as a lubricant but it also has a tendency to hold the oil to the surface of the cylinders and prevents it from vaporizing.



Automatic Dry Graphite Cylinder Lubricator

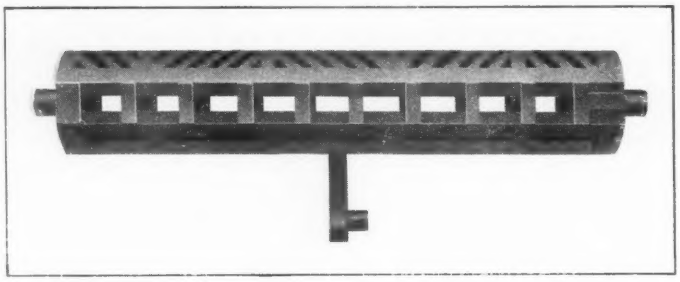
The lubricator is designed for engines using either saturated or superheated steam. Its cost is low; it is simple in construction and it may easily be installed. It feeds automatically and requires no attention aside from adding the graphite at the roundhouse. There is nothing in the mechanism which can get out of order and the feed of graphite cannot be tampered with. The construction of the device can be seen from the line drawing.

The lubricator may be applied anywhere on the steam chest or the relief valve pipe. The graphite is fed to the cylinders at all times, but the amount fed is greater when the engine is drifting than when steam is being used. It is claimed that this action of the lubricator makes it unnecessary to work steam on superheater engines while drifting.

It is claimed that the use of this graphite lubricator results in a saving in oil and a reduction in the wear of the cylinders, pistons and packing. It also makes the engine much easier to handle. The consumption of graphite is low, one-fourth pound being sufficient to lubricate one cylinder for 500 to 800 miles.

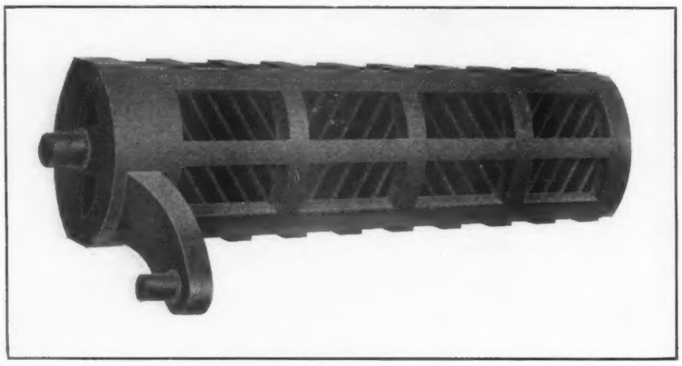
ELLIPTICAL GRATE BAR

A grate bar that has given noteworthy service in stationary and marine boiler practice and which has been adapted for locomotive use, is made by Thomas Grate Bar Company, Birmingham, Ala. As shown in the illustrations, this bar is elliptical in shape and of substantial construction. It has an upper and lower grid; the upper one to support the fire and the lower one to stiffen the bar structure. These grids are connected by lugs and are sufficiently far apart to permit free passage of the air through the grate.



Elliptical Grate Bar for Locomotives

The rounding upper surface has the effect of dislodging the ashes by an abrasive action, rather than by tearing the fire, as is done with table or figure grates. The ribs in the lower grid, acting as a support for the bar, permit making the upper grid with air openings as high as 66 per cent of the grate area. Reports from users of these grate bars indicate that on account of their substantial construction, they have a long life. The lower grids being below the intense heat of the fire and provided with ample surface for dissipating the



Bottom View of the Thomas Grate Bar

heat, do not readily become broken. It has also been found that less trouble is experienced with clinker, that the shape of the grates tends to keep them clean and that a uniform distribution of air to the fuel bed is obtained. It is also claimed by the users that less fuel is required and that greater steaming capacity is obtained from the boiler.

Another feature of this grate bar is that when the ribs in the upper grid become broken while in service, the hole can

be plugged by a clinker or other inert substance which will be supported by the ribs in the lower grid. This will give relief until such time as the bar can be replaced, and will prevent a serious hole in the fire. These bars are made of a grade of pig iron high in heat resisting qualities.

A CONVENIENT METHOD OF BOILER FEED WATER TREATMENT

Boiler compounds for the treatment of locomotive feed water are usually made up either in liquid or powdered form. The required amount must be applied to the tank each time the engine takes water, the effectiveness of the treatment, therefore, depending entirely upon the engine crew. It will generally be conceded that engine crews cannot be relied upon to give proper attention to matters of this kind.

A boiler compound, the special feature of which is the form in which it is prepared, has been developed by the Paige & Jones Chemical Company, New York. The chemical constituents, mixed with a suitable binder, are put up in hard balls, each about 3¼ in. in diameter and weighing one pound. The binder is of such a nature that the material dissolves slowly in cold water. The material is applied to the tender at the terminal and requires no attention whatever on the part of the engine crew. The required number of balls are placed in the tank by the hostler, the actual number depending upon the total amount of water fed to the boiler during the run to which the engine is assigned. As the weight of each ball is one pound, it is a simple matter to count out the required number of pounds and drop them in the tank before the locomotive leaves the roundhouse. The balls dissolve slowly, usually lasting from eight to nine hours. The motion of the engine causes them to roll about the tender, thus facilitating the thorough mixing of the chemicals with the water.

An anti-foam compound which is put up in the same form has also been developed by the same company. The anti-foam balls will last for 20 to 24 hours in cold water, thus eliminating the inconvenience of arranging for the constant application required where compounds put up in liquid form are used.

These compounds are in successful use on several railroads at the present time.

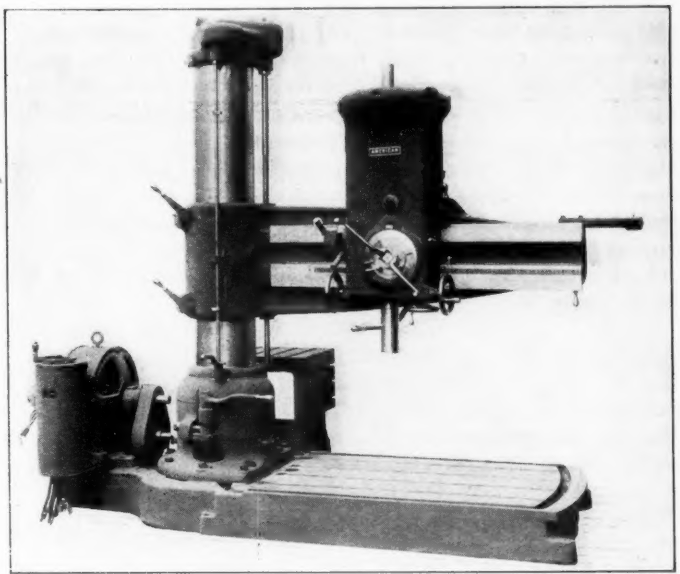
TRIPLE PURPOSE RADIAL DRILL

A radial 6-ft. drill that is adapted to boring operations in addition to the usual work of drilling and tapping, has recently been developed by the American Tool Works Company, Cincinnati, Ohio. This machine has an unusually wide range of spindle speeds. A distinct range of 16 speeds, from 15 to 81 r. p. m., is provided for heavy tapping and boring and a second range of 16 speeds, from 94 to 500 r. p. m., is provided for high speed drilling and light tapping. These speeds are in geometrical progression and the wide range makes possible the boring and high speed drilling operations. The different speeds are obtained through a quadruple geared head in conjunction with eight gear box speeds and is accomplished with only 15 gears.

The machine is provided with a double spindle drive as shown in one of the illustrations. The external gear provides the range of high speeds and the internal gear gives the range of low speeds. With this arrangement the wide range of speeds is obtained without resorting to small pinions or operating the gears at high velocities and without absorbing too much power. It would appear that with such a wide range of speeds there would be excessive gear velocities, but no gear on this machine runs faster than 1,000 ft. per minute for any of the speeds mentioned. The internal gear has a double spline on the spindle and is mounted on ball bearings.

One of the important improvements in this drill is in the tapping attachment. This mechanism is completely enclosed and runs in oil. The gears are of large diameter and are made of tough steel, being provided with bronze bushings. The friction bands are 8 in. in diameter and are adjusted from the outside.

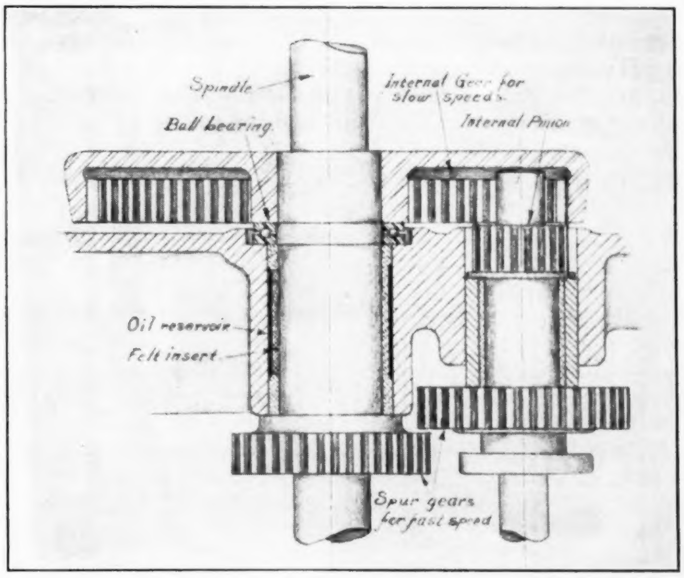
The feeding mechanism is direct-reading, and only one dial is required for its operation. There are eight feeds, ranging in geometrical progression from .005 in. to .04 in.



Radial Drill That Is Used for Boring Purposes

per spindle revolution. The mechanism is protected against sudden shocks or excessive stress by a friction connection between the mechanism and the spindle. This friction is of the expanding band type, and is quickly adjusted for any desired tension.

The counterweight is completely enclosed by the head casing and is provided with a safety stop which operates



Double Spindle Drive for Triple Purpose Radial Drill

automatically should the supporting chain break. The location of the counterweight near the spindle brings the center of gravity of the head and counterweight close to the head supports on the arm. This facilitates the movement of the head and also gives it a much better balance on the arm. The arm cannot be elevated until the binding levers are

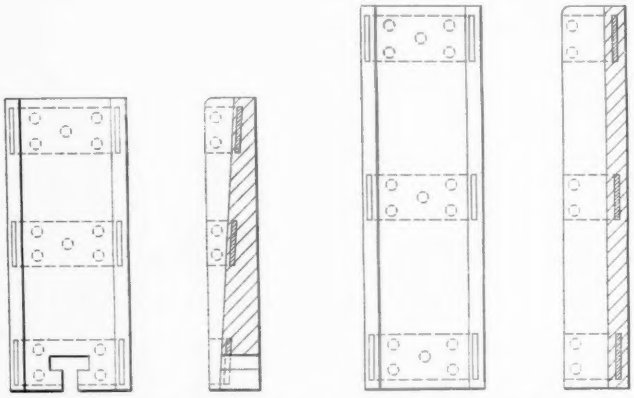
loosened. A safety friction is incorporated in the elevating gears, the slipping point of which is reached long before the resistance of the binders is overcome. This friction also serves another purpose. Whenever the elevating mechanism is engaged, there is a decided shock, which this mechanism absorbs, thereby protecting the shafts and gears. A "knock-out" mechanism on the elevating shaft automatically disengages the mechanism at the extreme upward or downward positions of the arm.

With the exception of a few bronze speed gears, every gear in the machine is steel. The pinions and clashing gears in the speed changing mechanism are heat treated and hardened. All shafts in the head and the gear box are made from crucible steel, while the long vertical and horizontal shafts are made from .45 per cent carbon stock. The bearings are bushed with phosphor bronze throughout and are all renewable. The oil ducts of the various bearings are brought to central locations on the head and cap, thus reducing the number of oil wells which must be given attention to two, and thus insuring a supply of oil to all of the bearings on the machine.

Special attention has been given to simplicity in construction and to convenience in operation. The fact that 32 spindle speeds are obtained with only 15 gears in the speed changing mechanism is especially noteworthy. The regular equipment of the machine includes a plain table, double friction countershafts and cone pulley drive. It may be provided, however, with the speed motor drives above described, a universal table, a power tapping mechanism, a positive arm support and bases designed to suit special requirements. The spindle has a traverse of 20 in. and the arm a traverse on the column of 46¾ in. At its highest point the spindle is 6 ft. 6 in. from the base. The traverse of the head on the arm is 63 in. The drill is designed for use with either a constant speed motor and speed box, a variable speed motor connected directly to the horizontal driving shaft at the bottom of the column or a countershaft and cone pulley drive.

REINFORCED SHOE AND WEDGE

A method of reinforcing cast iron shoes and wedges has been patented by J. C. Lyons, McComb, Miss. As shown in the illustration the reinforcement consists of steel plates 3/16 in. to ¼ in. thick formed so that there will be about ¼ in. of cast metal between the strips and the engine frame when the castings are finished. Holes punched through the strips tie this metal to the body of the casting. At the corner of the flange, which is the weak point in the casting, the strips are left solid to insure maximum strength and stiffness at this point. The molding of the reinforced castings requires but a small amount of additional time, as the strips are easily placed in the mold.



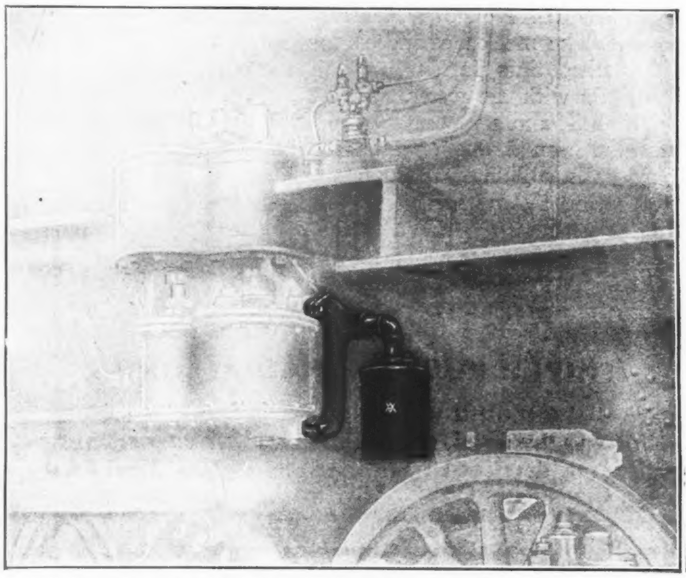
Shoes and Wedges Cast With Steel Reinforcing Strips

Since November, 1915, about 100 of the reinforced shoes and wedges have been placed in service on the engines of one division of a southern railroad. The reinforced castings were applied in running repairs in cases where the standard type of shoes and wedges were continually requiring renewal because of broken flanges. So far none of the reinforced shoes or wedges have broken. The reinforcing plates have been found particularly useful in the top part of wedges which are cut away at the top of the flanges for spring equalizers on underhung spring rigging.

WESTINGHOUSE "FIFTY-FOUR" AIR STRAINER

The demands of modern heavy locomotive and car equipment and the much longer trains which are now handled, have required a constantly increasing air supply during the last few years. This has been met by increased air compressor capacity and efficiency. The heavier demand upon the air strainer produced by the increased air compressor capacity has led to the development of a new design of strainer which has recently been brought out by the Westinghouse Air Brake Company, Wilmerding, Pa. The illustrations show the construction and method of attaching the strainer to the compressor.

The prime requirements of an air strainer are adequate capacity and ability to remove all grit or other foreign matter from the air before it reaches the compressor. Without sufficient strainer capacity, the compressor works against the handicap of a comparatively high vacuum at the suction and its capacity is thereby seriously affected. The desirability of thoroughly cleaning the air, from the standpoint of air pump maintenance, is self-evident. If the air carries dust or other foreign matter into the compressor, it not only causes undue cylinder wear, but results in choked air passages and overheating. Dirt is carried through the system, and the effect is felt on other parts of the locomotive equipment as well as the air pump.

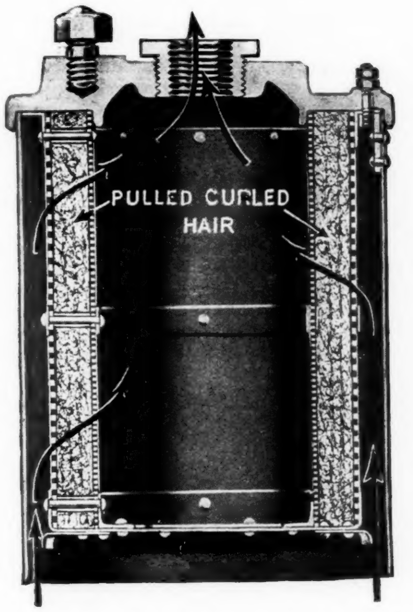


Air Strainer With Manifold Attachment Applied to an 8½-in. Cross-Compound Pump

To insure thorough cleaning in the new strainer, the air passes through a cylinder of pulled curled hair. This provides 54 sq. in. of intake screen area, which is large enough to prevent the formation of a high vacuum at the intake port. The relatively low velocity with which the air passes through the screen also facilitates the cleaning of the air. The strainer will run for a long period before cleaning is necessary. When it becomes desirable to renovate the curled

hair, however, the entire strainer is readily removed from the casing.

This strainer is designed primarily for use with the 8½-in. compound compressor, a manifold attachment having been designed so that but one strainer is required. It may be used to advantage, however, on either the 9½-in. or 11-in.

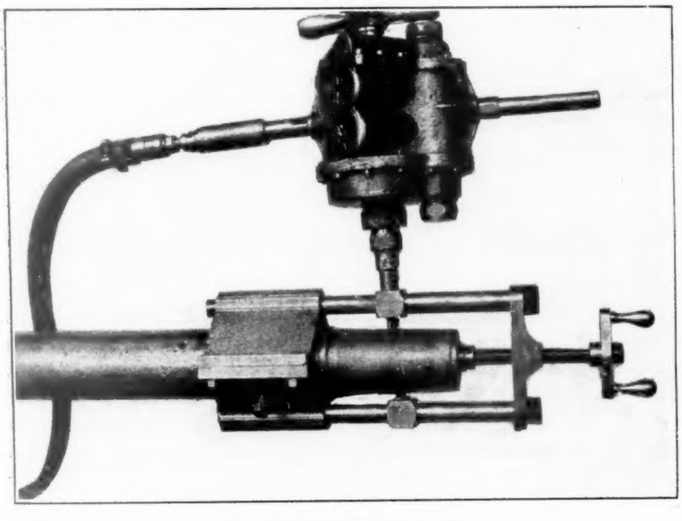


Section Showing the Construction of the Strainer

pump. The piping is arranged for close connection, but if desired, it may be run off to an isolated and more protected location. The strainer is tapped for a two-inch pipe, but may be fitted with a reducer for use on the smaller compressors.

PORTABLE PISTON ROD AND CROSSHEAD KEYWAY CUTTER

A simple device for cutting keyways in crossheads and piston rods is shown in the drawing. It is especially convenient for use in a small shop where machine tool facilities are limited. Two of these tools are required, one for cross-

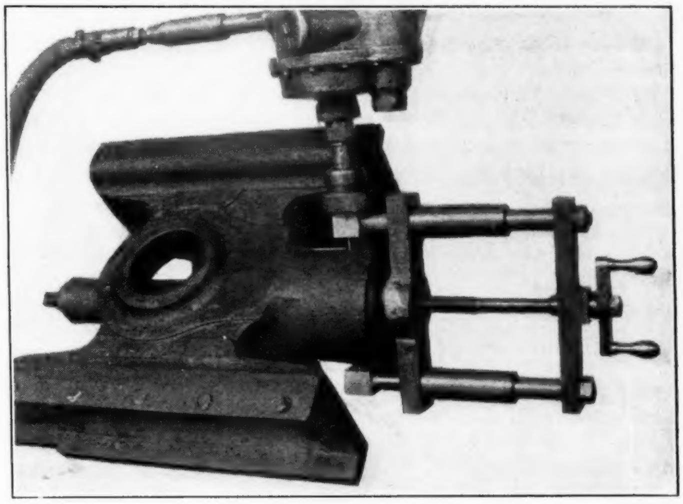


Piston Rod Keyway Cutter

heads and one for piston rods. Both operate on the same principle, but the difference in the shape of the pieces necessitates a slightly different construction for the two classes of work.

The crosshead device is centered in the piston rod fit. Before setting it up, however, a hole is drilled through the crosshead, at the location of one end of the keyway, and equal in diameter to the width of the keyway. The device is then set up on the crosshead, as shown in the illustration. The feed screw is run in and a reamer passed through the drilled hole and centered at the top and bottom in the two arms of the device. These arms terminate in hardened tool steel blocks to prevent wear. The reamer is driven by means of an air motor operating at about 250 r.p.m., and the keyway cut by drawing the reamer into the metal with the feed screw. A keyway in a crosshead such as that shown in the illustration can be finished in about 12 minutes.

The piston rod cutter is centered about the body of the rod, the centering sleeve being provided with extension lugs, through which operate the reamer guide rods. The operation of cutting the keyway in the piston rod is performed in the same manner as that in the crosshead. A hole is first drilled at the end of the keyway farthest from the end of the rod and the device set up with the reamer through



Keyway Cutter Applied to a Crosshead

this hole. After the motor has been attached and started, the reamer is drawn into the metal by the feed screw, the reaction being taken against the end of the piston rod. Piston rod keyways can be cut with this device in from six to fourteen minutes, depending upon the material and the size of the rod.

This device was designed and has been patented by Emmett G. Detrick, machine shop foreman, Yazoo & Mississippi Valley, Vicksburg, Miss.

Mild Steel for Locomotive Fire-Boxes.—The *Zeitschrift des Vereines Deutscher Ingenieure* of September 9, 1916, contained an article on the use of mild steel for locomotive fire-boxes, by Dr. Kittel, dealing particularly with tests conducted in the Technical High School at Stuttgart, with a very pure iron, a speciality of Krupp's works. This iron showed little of the critical temperature range, during which steels are apt to fail. In the issue of the same journal of November 25, Director Busse, of the Danish State Railway department, commenting on this article, says that he introduced mild steel fire-boxes 20 years ago, taking first American and then Krupp steel; the latter had answered better than the former. The tubes were expanded into the boxes with the aid of copper ferrules. Visiting the United States lately he had observed that repairs of fire-boxes were tolerated which European practice would hardly pass, and that on the whole, perhaps, the life of a fire-box depended more upon the way in which it was built and treated than upon the material.—*Engineering* (London).

Railway Mechanical Engineer

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WE GUARANTEE, that of this issue 8,925 copies were printed; that of these 8,925 copies, 7,805 were mailed to regular paid subscribers, 111 were provided for counter and news companies' sales, 271 were mailed to advertisers, 156 were mailed to exchanges and correspondents, and 582 were provided for new subscriptions, samples, copies lost in the mail and office use; that the total copies printed this year to date were 44,897, an average of 8,979 copies a month.

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VOLUME 91 MAY, 1917 NUMBER 5

CONTENTS

The passenger car shop of the Southern Railway at Meridian, Miss., was destroyed by fire on the night of April 15; estimated loss, $100,000.

The Baltimore & Ohio, the Pennsylvania and the Western Maryland have combined to provide a hospital train for the use, when needed, of Maryland soldiers. The train is being fitted up at the shops of the Western Maryland.

The Boston & Albany has made an advance of 5 per cent in the pay of all classes of employees who are not subject to the Adamson law, excepting those receiving $150 or more monthly. It is estimated that this will increase the annual payrolls about $250,000.

The shops of the Pullman Company, Pullman, Ill., have just completed a "service car" for the Department of Public Health of the United States government. The car is to be used by chemists who are to travel around the country to analyze drinking water supplied to passengers by the railroads.

C. R. Richards, professor of mechanical engineering of the University of Illinois and head of that department since 1911, has been appointed dean of the college of engineering and director of the engineering experiment station, to succeed W. F. M. Goss, who recently resigned to become president of the Railway Car Manufacturers' Association of New York.

The Great Northern has issued bulletins to its employees stating that all of its men enlisting in the army and navy of the United States will have their positions restored to them upon returning from such service, and also that all seniority and pension rights will be retained. The Northern Pacific has issued similar bulletins from the office of the vice-president.

Instructions have been issued from the office of the presi-

dent of the St. Louis-San Francisco to fly an American flag on each locomotive in service on the entire system. The stars and stripes, in addition, will be put on all station buildings along the line. Flags are to be furnished by the company, although it is stated that the idea originated with the employees themselves.

ORGANIZATION OF A MILITARY RAILWAY REGIMENT

A military railway regiment to assist the army by the construction and operation of railways in connection with military movements is now being organized under the direction of S. M. Felton, president of the Chicago Great Western at Chicago. The new organization will consist of one company each from the following Chicago railroads: The Illinois Central, the Chicago Great Western, the Chicago & North Western, the Chicago, Milwaukee & St. Paul, the Chicago, Rock Island & Pacific and the Atchison, Topeka & Santa Fe. Several months previous to the declaration of war Mr. Felton, who was appointed consulting engineer and adviser to the chief of engineers of the United States Army at the time of threatened hostilities on the Mexican border, was directed to perfect plans for the formation of the new army unit.

Simultaneously with the entrance of the United States into the war, steps were taken to form the regiment. Each railway is furnishing one company of which the captain will be a division superintendent, the lieutenants a chief despatcher, an engineer maintenance of way, a road foreman of engines, and a trainmaster or master mechanic, and the remaining 164 men will be recruited from all branches of railroad service. Non-commissioned officers will be drawn from men of the rank of track supervisors, bridge supervisors, roundhouse foremen, assistant engineers, section foremen, bridge foremen, etc. Among the employees desired to fill the ranks are those holding such positions as conductors, brakemen, yard foremen, despatchers, track foremen, electricians, bridge and building foremen, car inspectors, wrecking foremen, storekeepers, traveling engineers, roundhouse foremen, locomotive engineers and firemen, stationary enginemen, switchmen, oilers, machinists, operators, yardmasters, pumpmen, linemen, locomotive inspectors, boiler makers, blacksmiths, stenographers, surveyors, car repairers, clerks, carpenters, masons, pile driver men, plumbers, agents, etc. In addition to four commissioned officers for each company, consisting of a captain and three lieutenants, the railways will furnish two majors, two captain adjutants, one captain quartermaster, and one captain engineer. The colonel, the lieutenant colonel and his captain adjutant will be regular army officers.

Each company will be expected to be capable of taking over a section of railroad of approximately 100 miles in length and to operate it in the same manner that it might handle the work of a division on its own line. The engineering officers of each unit are also expected to be prepared to handle expeditiously the construction of any lines that military operations may necessitate. Those enlisting become members of the United States Engineer Enlisted Reserve Corps, while those commisisoned as officers are admitted to the United States Engineer Officers Reserve Corps as provided for in the National Defense Act of June 3, 1916.

NO LABOR DISPUTES DURING THE WAR

The Council of National Defense has adopted a report of its labor committee, of which Samuel Gompers, president of the American Federation of Labor, is chairman, recommending that the council shall issue a statement to employers and employees in industrial plants and transportation systems advising that neither employers nor employees shall endeavor to take advantage of the country's necessities to change existing standards of wages and working conditions. It is recommended that when economic or other emergencies arise requiring changes of standards, the same should be made only after such proposed changes have been investigated and approved by the Council of National Defense. It was also recommended that the council urge upon the legislatures of the states that before final adjournment they delegate to the governors of the respective states power to suspend or modify restrictions contained in their labor laws when requested by the Council of National Defense for a specified period, not to exceed the duration of the war. The labor committee includes Warren S. Stone, grand chief of the Brotherhood of Locomotive Engineers, and Elisha Lee, general manager of the Pennsylvania Railroad.

TRADE JOURNALS DECLARE FOR UNIVERSAL SERVICE

The New York Business Publishers' Association, composed of the trade and technical journals in New York, unanimously adopted resolutions at its monthly meeting on April 23, indorsing universal military training and service, and pledging its support to the government in the sale of bonds necessary to carry on the war.

The editorial conference of the New York Business Publishers' Association, Inc., has also pledged its support. An offer to the government by 277 class journals of the United States to give editorial co-operation and free advertising space to support government activities in connection with the war was made last week. The telegrams offering this cooperation were taken to Washington on April 17 by Arthur J. Baldwin, vice-president, McGraw-Hill Publishing Company, and A. C. Pearson, secretary of the United Publishers' Corporation. They were received by Secretary Daniels of the Navy Department; George Creel, the recently appointed head of the Board on Censorship and Publicity; Grosvenor B. Clarkson, secretary of the Council of National Defense, and Howard E. Coffin, of the Advisory Board to the Council. The *Railway Mechanical Engineer* and all other Simmons-Boardman papers are members of the New York Business Publishers' Association, Inc., and of the editorial conference.

CAR AND LOCOMOTIVE ORDERS IN APRIL

In April this year, as in last, the orders for cars and locomotives fell off slightly from the level set in the earlier months of the year. That this year's orders have held up as well as they have in the uncertainty following upon the declaration of war, however, is gratifying. The totals for the month were as follows:

	Locomotives	Freight cars	Passenger cars
Domestic	240	3,623	40
Foreign	84	...	..
Total	324	3,623	40

The locomotive orders included the following:

Buffalo, Rochester & Pittsburgh	10	Mallet	American
	5	Pacific	American
	4	Switching	American
Canadian Government Railways	30	Mikado	American
	10	Pacific	American
	10	Santa Fe	American
Chicago & North Western	50	Mikado	American
Pere Marquette	15	Santa Fe	American
	6	Switching	American
Russian Government	53	Narrow gage Mallet	Baldwin
	60	Decapod	Baldwin
South African Railways	8	Mallet	American
	10	Mountain	American

Among the important freight car orders was the Philadelphia & Reading's order for 2,000 cars divided as follows: 500 gondola, Standard Steel Car Company; 500 gondola, Pressed Steel Car Company; 500 box, American Car & Foundry Company and 500 box, Pullman Company.

The Chicago, Milwaukee & St. Paul ordered 20 baggage cars from the Standard Steel Car Company and the Great Northern, 20 baggage and mail cars from the American Car & Foundry Company.

MEETINGS AND CONVENTIONS

Boiler Makers' Supply Men's Association.—The executive committee of the supply manufacturers' organization which meets in conjunction with the Master Boiler Makers' Association has decided not to hold an exhibit this year.

Railway Supply Manufacturers' Association.—E. H. Walker, president of the Railway Supply Manufacturers' Association on April 18 announced to the members that the convention of that association, which was to have been held at Atlantic City, N. J., June 13 to 20, has been postponed for one year. This action was taken after a general expression of opinion of the members, who feel that their time and resources should be conserved for the better service of the country in meeting the extraordinary demands arising from our entrance into the war.

St. Louis Railway Club.—The annual election of the St. Louis Railway Club took place at the American Annex hotel, St. Louis, on April 13. The following officers were elected for the coming year: President, M. O'Brien, master mechanic, United Railways of St. Louis; first vice-president, W. S. Williams, division superintendent, Illinois Central, Chicago, Ill.; second vice-president, J. A. Somerville, general superintendent of transportation, Missouri Pacific-St. Louis, Iron Mountain & Southern; third vice-president, F. W. Green; secretary-treasurer, B. W. Frauenthal, ticket agent, Union Station, St. Louis.

Pacific Railway Club.—The Pacific Railway Club was organized in San Francisco, Cal., on March 1. The club was formed after a letter ballot had been taken of all railway officers in the cities about San Francisco bay to determine whether there was a general need of a forum where matters relating to railway construction, operation and maintenance might be presented and discussed. As the ballot was preponderantly in favor of such an organization a meeting was held to effect its formation, and 86 charter members, including employees of 10 railroads and the professors of railroad engineering and economics of the University of California and Leland Stanford University, were taken in. The officers elected for the club's first year are: President, A. H. Babcock, consulting electrical engineer, Southern Pacific; first vice-president, G. H. Binkley, valuation engineer, United Railways of San Francisco; second vice-president, P. P. Hastings, assistant general freight agent, Atchison, Topeka & Santa Fe; treasurer, B. W. Perrin, division engineer, suburban lines, Southern Pacific; secretary, W. S. Wollner, assistant to the chief engineer, Northwestern Pacific.

Interchange Car Inspectors' and Car Foremen's Supply Men's Association.—During the past few years numerous manufacturers of railway supplies and appliances have arranged exhibits at the time of the annual conventions of the Chief Interchange Car Inspectors' and Car Foremen's Association. In order to facilitate the work for the companies desiring to make exhibits at that time, a permanent organization has been formed which will be known as the Interchange Car Inspectors' and Car Foremen's Supply Men's Association. At a meeting held at the Hotel La Salle, Chicago, on April 9, a constitution and by-laws were drawn up and the following officers were elected: President, L. S. Wright, National Malleable Castings Company; first vice-president, C. D. Derby, Joyce-Cridland Company; second vice-president, W. G. Willcoxson, Boss Nut Company; secretary, D. B. Wright, the Lehon Company; treasurer, J. R. Mitchell, with W. H. Miner. The executive committee of the association is to be made up of nine representatives of supply companies, three to be elected each year for a term of three years, and the secretary of the Chief Interchange Car Inspectors' and Car Foremen's Association. The following were elected members of the executive committee for three years: W. G. Wallace, American Steel Foundries; C. N. Thulin, Duff Manufacturing Company; D. B. Sissons, Imperial Appliance Company. The members elected for two years are: C. J. W. Clasen, the Bettendorf Company; C. J. Wymer, the Grip Nut Company; W. H. Pratt, Heath & Milligan; and the following were elected for one year: A. H. Beatty, Templeton-Kenly & Co.; J. E. Tarelton, Union Draft Gear Company; D. F. Jennings, of Guilford S. Wood.

The following list gives names of secretaries, dates of next or regular meetings and places of meeting of mechanical associations:

Air Brake Association.—F. M. Nellis, Room 3014, 165 Broadway, New York City. Convention, May 1-4, 1917, Memphis, Tenn.

American Railroad Master Tinners', Coppersmiths' and Pipefitters' Association.—O. E. Schlink, 485 W. Fifth St., Peru, Ind. Convention, June 26-29, 1917, Marquette Hotel, St. Louis, Mo.

American Railway Master Mechanics' Association.—J. W. Taylor, Karpen Building, Chicago. Convention postponed.

American Railway Tool Foremen's Association.—R. D. Fletcher, Belt Railway, Chicago. Convention, August 30, 31 and September 1, 1917, Hotel Sherman, Chicago.

American Society for Testing Materials.—Prof. E. Marburg, University of Pennsylvania, Philadelphia, Pa.

American Society of Mechanical Engineers.—Calvin W. Rice, 29 W. Thirty-ninth St., New York.

Association of Railway Electrical Engineers.—Joseph A. Andreucetti, C. & N. W., Room 411, C. & N. W. Station, Chicago.

Car Foremen's Association of Chicago.—Aaron Kline, 841 Lawlor Ave., Chicago. Second Monday in month, except June, July and August, Hotel La Salle, Chicago.

Chief Interchange Car Inspectors' and Car Foremen's Association.—W. R. McMunn, New York Central, Albany, N. Y. Convention, September 25, 26 and 27, 1917, St. Louis, Mo.

International Railroad Master Blacksmiths' Association.—A. L. Woodworth, C. H. & D., Lima, Ohio. Convention, August 21, 1917, Hotel Sherman, Chicago.

International Railway Fuel Association.—J. G. Crawford, 547 W. Jackson Blvd., Chicago. Convention, May, 1917, Chicago.

International Railway General Foremen's Association.—William Hall, 1126 W. Broadway, Winona, Minn. Convention, September 4-7, Hotel Sherman, Chicago, Ill.

Master Boilermakers' Association.—Harry D. Vought, 95 Liberty St., New York. Convention, May 22-25, 1917, Richmond, Va.

Master Car Builders' Association.—J. W. Taylor, Karpen Building, Chicago. Convention postponed.

Master Car and Locomotive Painters' Association of U. S. and Canada.—A. P. Dane, B. & M., Reading, Mass. Convention, September 11, 1917, Hotel La Salle, Chicago.

Niagara Frontier Car Men's Association.—E. N. Frankenberger, 623 Brisbane Building, Buffalo, N. Y. Meetings, third Wednesday in month, New York Telephone Bldg., Buffalo, N. Y.

Railway Storekeepers' Association.—J. P. Murphy, Box C, Collinwood, Ohio. Convention, May 21-23, 1917, Chicago, Ill.

Traveling Engineers' Association.—W. O. Thompson, N. Y. C. R. R., Cleveland, Ohio.

RAILROAD CLUB MEETINGS

Club	Next Meeting	Title of Paper	Author	Secretary	Address
Canadian	May 8, 1917	Annual Meeting, Smoker and Entertainment		James Powell	P. O. Box 7, St. Lambert, Que.
Central	May 11, 1917	Lubrication of Freight Car Equipment	T. J. Burns	Harry D. Vought	95 Liberty St., New York.
Cincinnati	May 8 1917	The Safety Appliance Standards: Purposes and Reasons for Locations	H. W. Belnap	H. Boutet	101 Carew Bldg., Cincinnati, Ohio.
New England	May 8, 1917	Wheels and Rails		Wm. Cade, Jr.	683 Atlantic Ave., Boston, Mass.
New York	May 18, 1917			Harry D. Vought	95 Liberty St., New York.
Pittsburgh	May 25, 1917	Iron Car Wheel	George W. Lyndon	J. B. Anderson	207 Penn Station, Pittsburgh, Pa.
Richmond	May 14, 1917	Korea, Moving Picture	H. Webster	F. O. Robinson	C. & O. Railway, Richmond, Va.
St. Louis	May 11, 1917	Safety Appliance Standards: Moving Picture, "King of the Rails"	H. W. Belnap	B. W. Frauenthal	Union Station, St. Louis, Mo.
South'n & S'w'rn.	May 19, 1917			A. J. Merrill	Box 1205, Atlanta, Ga.
Western	May 21, 1917	Annual Meeting		J. W. Taylor	1112 Karpen Bldg., Chicago.

PERSONAL MENTION

GENERAL

WALTER ALEXANDER, chairman of the Railroad Commission of Wisconsin, has been appointed superintendent of motive power of the Chicago, Milwaukee & St. Paul, with office at Milwaukee, Wis., succeeding A. E. Manchester, promoted to general superintendent. Mr. Alexander was born in Glasgow, Scotland, in 1872, and was brought to this country in 1873. He received a common school education in Milwaukee, and served an apprenticeship as a machinist and draftsman with the St. Paul, later being employed as a fireman on the same road. He entered the University of Wisconsin in 1893, and graduated from the course in mechanical engineering in 1897, receiving a second degree in engineering the following year. For three years he was an instructor in engineering at the University of Wisconsin, one year at Armour Institute and one at the University of Missouri. He then returned to railway work as assistant district master mechanic of the St. Paul at Minneapolis, Minn. Two years later he was transferred to Milwaukee, Wis., to a similar position, and later was promoted to district master mechanic at that point. He became a member of the Wisconsin Railroad Commission of Wisconsin in February, 1915, and in August, 1916, was appointed chairman to succeed Halford Erickson.


W. Alexander

DANIEL P. KELLOGG has been appointed superintendent of motive power for the Southern Pacific, with headquarters at Sacramento, Cal., as announced in these columns last month. He was born at Alliance, Ohio, April 17, 1869. In June, 1889, he entered railway service as a machinist apprentice with the Missouri Pacific in Kansas. During 1892 he was engaged in installing machinery in contract shops in Utah and the following year was appointed roundhouse foreman for the Chicago, Milwaukee & St. Paul in Wisconsin. From 1896 to 1897 and during part of 1898 he was assistant general foreman of the Duluth & Iron Range at Two Harbors, Minn., being then appointed air brake inspector for the Southern Pacific at Oakland, Cal. In the latter part of 1898 he was promoted to general foreman of locomotives for this company, and in 1904 was transferred to Bakersfield, Cal., with the title of master mechanic. From 1906 to 1910 he was master mechanic at Los Angeles, Cal., and he was then advanced to superintendent of shops with the same headquarters, which latter position he continued to fill up to March 1, 1917, when his present appointment became effective.


D. P. Kellogg

R. C. BARDWELL, chemist of the Missouri Pacific at Kansas City, has been promoted to assistant engineer in charge of water treatment of the Missouri Pacific and the St. Louis, Iron Mountain & Southern, with headquarters at St. Louis, Mo.

W. J. EDDY, master mechanic of the Chicago, Rock Island & Pacific at El Dorado, Ark., has been appointed superintendent of fuel economy. The engineer of fuel economy and the supervisor of stationary plants will report to him.

J. E. MCQUILLEN, mechanical superintendent of the Gulf, Colorado & Santa Fe, with office at Cleburne, Tex., has had his headquarters moved to Galveston, Tex.

E. F. THOMSON, chief clerk to the president of the Chicago, Indianapolis & Louisville at Chicago, Ill., has been appointed assistant to the superintendent of motive power at Lafayette, Ind.

MASTER MECHANICS AND ROAD FOREMEN OF ENGINES

D. S. BAALS, assistant trainmaster and road foreman of engines of the Chesapeake & Ohio, at Cane Fork, W. Va., has been transferred in the same capacity to the Big Sandy division, with headquarters at Paintsville, Ky., succeeding M. B. Daniels assigned to other duties.

A. H. BINNS has been appointed acting master mechanic on the Trenton division, Ontario district, Canadian Pacific, with office at Trenton, succeeding T. H. Hamilton, transferred temporarily.

E. J. BUCKBEE, master mechanic of the Cleveland, Cincinnati, Chicago & St. Louis at Mt. Carmel, Ill., has been transferred to Mattoon, Ill., succeeding J. J. Karibo, transferred.

JOSEPH F. DONELLAN has been appointed master mechanic of the Pennsylvania division of the Delaware & Hudson, with office at Carbondale, Pa., succeeding George S. Graham, resigned.

W. H. DYER, master mechanic of the Georgia & Florida, at Douglas, Ga., has had his jurisdiction extended over the Augusta Southern.

J. L. JAMIESON, heretofore road foreman of locomotives of the Canadian Pacific at Medicine Hat, Alta., has been appointed road foreman of locomotives at Ignace, Ont.

ALBERT H. KENDALL, formerly master mechanic of the Canadian Pacific, Ontario district, has been appointed captain, No. 1 Section, Skilled Railway Employees, recently organized to operate 300 miles of double track railway which is now completed in the northern part of France. Mr. Kendall's photograph and a sketch of his career were published in the *Railway Mechanical Engineer* for December, 1916.

C. L. SHARP, general foreman of locomotives, Chicago, Rock Island & Pacific, at Shawnee, Okla., has been appointed master mechanic of the Louisiana division at El Dorado, Ark., succeeding W. P. Eddy, promoted.

D. M. SMITH, heretofore road foreman of locomotives of the Canadian Pacific at Kenora, Ont., has been appointed road foreman of locomotives at Medicine Hat, Alta., succeeding J. L. Jamieson, transferred.

G. P. TRACHTA, road foreman of engines of the Chicago, Burlington & Quincy at McCook, Neb., has been appointed

master mechanic at Casper, Wyo., succeeding J. O. McArthur, transferred.

A. R. Thompson has been appointed road foreman of engines of the Chesapeake & Ohio, with headquarters at Cane Fork, W. Va., succeeding D. S. Baals transferred.

CAR DEPARTMENT

A. E. Chesterman, heretofore car foreman of the Canadian Pacific at Crowsnest, B. C., has been appointed car foreman at Field, B. C., succeeding A. E. Tasker, transferred.

James Hall, formerly master car repairer of the Southern Pacific, on the Coast division, at San Francisco, Cal., has been appointed general foreman of passenger cars in charge of repairs and construction, at Sacramento, Cal.

C. W. McClear, heretofore coach carpenter of the Canadian Pacific at Vancouver, B. C., has been appointed car foreman at Crowsnest, B. C., succeeding A. E. Chesterman, transferred.

W. Peat, heretofore car foreman of the Megantic division, Quebec district of the Canadian Pacific, at Megantic, Que., has been transferred to the Western lines with headquarters at Vancouver, B. C.

A. E. Tasker, car foreman of the Canadian Pacific at Field, B. C., has been appointed car foreman at Winnipeg, Man.

SHOP AND ENGINEHOUSE

D. E. Barton has been appointed acting superintendent of shops of the Atchison, Topeka & Santa Fe at Albuquerque, N. M., succeeding W. A. George, granted leave of absence.

William R. Downs, formerly foreman boiler maker at the Avis shops of the New York Central, has been appointed assistant general foreman at that point.

John Fraser has been appointed locomotive foreman of the Grand Trunk at Edmundston, N. B., succeeding C. White, transferred.

J. McGowan, formerly locomotive foreman of the Canadian Pacific at Rogers Pass, B. C., has been appointed locomotive foreman at Strathcona, Alta, succeeding G. Pratt transferred. The position of locomotive foreman at Rogers Pass has been abolished, owing to the placeing in operation of the Connaught tunnel.

H. E. Oplinger, general foreman of the Atlantic Coast Line at Brunswick, Ga., has been transferred to Charleston, S. C., in the same position, to succeed M. L. Gray, who has resigned.

G. Pratt, locomotive foreman of the Canadian Pacific at Strathcona, Alta., has been appointed locomotive foreman at Medicine Hat, Alta., succeeding J. Perry, assigned to other duties.

O. B. Schoenky, superintendent of shops of the Southern Pacific at Sacramento, Cal., has been transferred to Los Angeles, as superintendent of shops at that point, succeeding D. P. Kellogg, promoted.

C. White, locomotive foreman of the Canadian Government Railways at Edmundston, N. B., has been appointed locomotive foreman at Napadogan, N. B., succeeding W. C. Williams.

PURCHASING AND STOREKEEPING

Frank S. Austin has been appointed general storekeeper of the Boston & Albany, with headquarters at West Springfield, Mass. He was born on November 6, 1886, at Lynn, Mass., and attended Ingalls Grammar School, also the English High School of his native city and graduated from Dartmouth College in 1909. The same year he began railway work with the Boston & Albany, and has been in the continuous service of that road ever since. He served as assistant to the supervisor of track at Pittsfield, Mass., until 1911, and then for two years in the same capacity at Springfield. In 1913 he was appointed supervisor of track at Worcester, and three years later became supervisor of track at Boston, which position he held at the time of his recent appointment as general storekeeper.

P. E. Bast, fuel inspector of the Delaware & Hudson at Colonie, N. Y., has been appointed fuel agent, with office at Albany, N. Y.

S. G. Denman, heretofore assistant purchasing agent of the Canadian Pacific at Vancouver, B. C., has been appointed assistant purchasing agent at Calgary, Alta., succeeding J. T. H. Ferguson, transferred to Vancouver.

J. T. H. Ferguson, heretofore assistant purchasing agent of the Canadian Pacific at Calgary, Alta., has been appointed assistant purchasing agent at Vancouver, B. C., succeeding S. G. Denman, transferred to Calgary, Alta.

C. F. Ludington, chief fuel supervisor of the Atchison, Topeka & Santa Fe, at Topeka, Kan., has resigned to accept a similar position with the Missouri, Kansas & Texas, with headquarters at Parsons, Kan.

F. McDowell, heretofore general foreman of the Winnipeg stores of the Canadian Northern has been appointed storekeeper, with jurisdiction over all matters regarding Winnipeg stores. He reports to the general storekeeper. His office is at Winnipeg, Man.

S. W. Saye, purchasing agent of the Georgia & Florida at Augusta, Ga., has had his authority extended over the Augusta Southern.

C. T. Winkless has been appointed superintendent of fuel of the Chicago, Rock Island & Pacific, with headquarters at Chicago, Ill. He will have charge of fuel purchase, distribution and handling.

OBITUARY

Michael J. McAndrew, traveling engineer of the Michigan Central, Canadian lines, died suddenly in the office of the roundhouse at Victoria, Ont., on March 20, 1917.

George H. Price, chief car inspector of the Nashville, Chattanooga & St. Louis, at Chattanooga, Tenn., died at his home in Chattanooga on March 31, 1917.

George Woolley Strattan, retired master mechanic of the Altoona machine shops of the Pennsylvania Railroad, died at Easton, Pa., on April 14, 1917. Mr. Strattan was born in Philadelphia, Pa., on January 26, 1836, but subsequently lived in New York where his education was completed. He worked as a clerk for a short time, but on May 15, 1858, entered the works of William Sellers & Company as a machinist apprentice. After completing his apprenticeship he came to Altoona on March 14, 1861, entering the service of the Pennsylvania Railroad. On January 28, 1863, he went with the Freedom Iron Company at Lewistown, Pa., but on September 22, 1864, he returned to Altoona and again became connected with the Pennsylvania Railroad. Early in 1865 he was made a gang foreman and on March 3, 1867, he was advanced to assistant master mechanic of the Altoona machine shops. On October 1, 1870, he was promoted to the position of master mechanic, which he held until his retirement on January 31, 1906. When he was made master mechanic he had about 1,000 men under his direct control; when he retired, the workmen numbered about 5,600. In addition to having charge of the Altoona machine shops, he was in charge of the East Altoona, Hollidaysburg, Huntington and Mifflin shops, and other points along the Middle division.

Supply Trade Notes

Henry B. Oatley, chief engineer of the Locomotive Superheater Company, has been called to active duty as a lieutenant in the New York naval reserves.

B. John Buell, formerly with the Spencer Otis Company of Chicago, has been appointed general manager of the Reading Specialties Company, Reading, Pa.

The Pullman Company on May 1 will move its New York offices from the Mills building, 15 Broad street, to room 2612 in the Adams Express building at 61 Broadway.

A. C. Loudon, formerly managing editor of the *Railway Mechanical Engineer*, has joined the staff of the Locomotive Superheater Company, 30 Church street, New York.

The Pyle-National Company, Chicago, announces that after April 8, 1917, its general offices will be located at 1334 North Kostner avenue, Chicago, instead of 900 South Michigan avenue, as heretofore.

K. J. Eklund, assistant to the president of the Pilliod Company, with office at New York, has been transferred to the Chicago office as assistant to Burton W. Mudge, president of Mudge & Co. and vice-president of the Pilliod Company.

H. S. Mikesell, assistant manager, mining department of the Chicago, Rock Island & Pacific, has resigned to become vice-president and treasurer of Mikesell Brothers, Chicago, Ill., manufacturers of asbestos listing, packings and brake linings.

Don B. Sebastian, fuel agent of the Chicago, Rock Island & Pacific, has resigned to become associated with the Bickett Coal & Coke Company, Chicago, Ill. Mr. Sebastian will be elected a vice-president of the company at its next annual meeting.

J. M. Borrowdale, formerly superintendent of car construction for the Illinois Central, with office at Chicago, Ill., has been appointed car specialty representative of the general railroad department of the H. W. Johns-Manville Company, Chicago.

Leon P. Alford, editor of the American Machinist for the past 10 years, has recently become associated with Industrial Management, formerly Engineering Magazine, as editor-in-chief. He has been succeeded as editor of the American Machinist by John H. Van Deventer.

The Rome Merchant Iron Mill, of Rome, N. Y., has been reincorporated under the name of Rome Iron Mills, Inc. This change was made to provide for an increased capitalization necessitated by a large increase in facilities for the manufacture of hollow staybolt iron. There has been no change in the management.

The Louisville Car & Foundry Company, Louisville, Ky., will soon increase its capital stock to $60,000 and engage in the building of tank cars, besides rebuilding and general repairing of railway equipment. The officers of the new company are Charles Schimpeler, president; C. H. Schimpeler, vice-president, and Henry Schimpeler, secretary.

George C. Fisk, formerly president of the Wason Manufacturing Company, of Springfield, Mass., died at his home in Springfield on April 6, at the age of 86. Mr. Fisk began work for the Wason Manufacturing Company about 1852 as bookkeeper, and became president in 1870. This company was absorbed in 1907 by the J. G. Brill Company, of Philadelphia.

Elbert H. Gary, chairman of the board of the United States Steel Corporation, announced on March 3 that it had been decided to increase about ten per cent the wage rates and salaries up to $2,500, of employees of the subsidiary companies, to take effect on May 1. This makes the fourth advance of ten per cent since the first of 1916, making a total increase of more than 46 per cent compounded.

The Keith Railway Equipment Company, Chicago, announces that it has purchased all of the property, assets, business, contracts and good will of the Keith Car Company. The new company will continue to conduct the business under the same management and in the same manner as in the past. It is stated further that it will broaden its field by handling a line of railway mechanical supplies.

W. A. Means, secretary of the B. F. Goodrich Company, has been elected second vice-president of the company and has been succeeded as secretary by L. D. Brown, cashier of the First-Second National Bank of Akron. Mr. Means has been connected with the B. F. Goodrich Company for almost 20 years. He has been treasurer for seven years, previous to which he was assistant treasurer for 12 years.

Fire originating in the upholstery department of the Pullman Company, Chicago, Ill., caused approximately $100,000 damage on the night of March 9. The building, which was two stories high, of brick construction, and 250 ft. by 150 ft., was protected by four thick fire walls, two of which were burned entirely through. Besides the destruction of the building itself much valuable material, such as plush draperies, valuable hard woods and oils, was consumed by the flames.

Detailed plans have been completed and are in the course of execution for rebuilding the burned portion of the plant of the Hydraulic Press Manufacturing Company, on its present site in Mount Gilead, Ohio. The plans also include the erection of two additional buildings which will give more adequate manufacturing facilities for the rapidly expanding business. In all, the plans cover the erection of four complete new buildings consisting of a machine shop, a three-story stock room, a new power plant and a structural and forge shop. The machine shop and stock room are replacements on a much larger scale of the portion of the plant recently destroyed by fire. It is planned to have the new buildings in operation by July 1.

The Bradford-Ackermann Corporation, recently formed by A. H. Ackermann and C. C. Bradford, with offices in the 42nd Street building, New York, announces that it has concluded arrangements with Ashton, Laird & Co. for the sole selling rights of "Astra" high temperature gas apparatus and oxygen welding appliances, manufactured from the designs and patents of E. Raven Rosen-Baum, consulting engineer on high temperature gases. In addition to the extensive line of oxy-acetylene welding appliances, there will be marketed a new and standardized line of oxy-illuminating gas apparatus exclusively manufactured by this company. In this process either natural or artificial illuminating gas, direct from the town supply, is substituted as a supporting gas in connection with oxygen.

Robert W. Hunt & Co. has offered the services of its entire bureau of inspection, tests and consultation to the government at actual cost in a letter to the Secretary of War dated April 20. This includes all of the 700 employees in the main office at Chicago and in the branch offices and laboratories in New York City, Pittsburgh, St. Louis, San Francisco, Montreal and London. This offer is made in the belief that this large and highly specialized organization can be of service to the country in a particularly practical manner at less cost to the country than equivalent services can be obtained otherwise. The acceptance of this proposal will relieve government officers from inspection duties for services of greater value in other directions, and will enable the government to utilize this organization intact without the necessity of gathering together other men into a similar organization which it would take

time to develop. In addition to its work for many of the railways and other large private corporations, this company is now and has been performing inspection work for the British, Russian, Italian, Netherland and French governments, not only on munition orders, but also on steel rails and their fastenings and other railway equipment.

The Vapor Car Heating Company, Inc., has taken over all of the heating and ventilating business of the Chicago Car Heating Company and the Standard Heat & Ventilation Company, Inc. The main office and headquarters of the consolidated company will be in the Railway Exchange, Chicago. The following officers have been elected: Egbert H. Gold, president; J. E. Buker and J. Allan Smith, vice-presidents; Samuel Higgins, vice-president and treasurer; Winthrop Gold, assistant treasurer; Edward A. Schreiber, general manager; Arthur P. Harper, secretary and controller, and Otto R. Barnett, general counsel. Branch offices have been established in New York City in charge of Samuel Higgins and George T. Cooke; Boston, Mass., in charge of Frank F. Coggin; Montreal, Can., in charge of F. A. Purdy, and S. P. Harriman; Washington, D. C., in charge of Harry F. Lowman, and Atlanta, Ga., in charge of Lewis B. Rhodes.

Frederick C. Blanchard, who was recently elected vice-president in charge of manufacturing for the Detroit Lubricator Company, with headquarters at Detroit, Mich., was born in Boston, Mass., October 19, 1869. He graduated from the Massachusetts Institute of Technology with a degree in mechanical engineering in 1891. Prior to being elected to the above position he was for four years production manager for the Fort Wayne Electric Works, Fort Wayne, Ind., leaving this concern to become works manager of the Ashcroft Manufacturing Company and the Consolidated Safety Valve Company owned by Manning, Maxwell & Moore, New York City. Later he was made chairman of the manufacturing committee of the latter corporation, then being elected a member of the board of directors. He has now resigned these several connections to take charge of the manufacturing department of the Detroit Lubricator Company.

F. C. Blanchard

E. N. Layfield, secretary of the Western Society of Engineers, has resigned, effective May 1, to become associated with W. F. M. Goss, president of the Railway Car Manufacturers' Association. Mr. Layfield has been secretary of the Western Society of Engineers for about a year, practically all of his previous experience having been in railway engineering work. Beginning in 1892 he was employed in maintenance of way and construction on the Pennsylvania Railroad between Philadelphia and Washington. He entered the services of the Chicago Terminal Transfer Company in 1899, serving as chief engineer of that company from 1905 till 1910, when the road was taken over by the Baltimore & Ohio as the Baltimore & Ohio Chicago Terminal. He remained with the last named company one year longer in the capacity of division engineer, when he resigned to engage in private consulting practice, specializing in grade separation investigations. He accepted the position of assistant secretary of the Western Society of Engineers late in 1915, and was appointed secretary on January 21, 1916. Mr. Layfield's headquarters will be with Mr. Goss at 61 Broadway, New York, the headquarters of the association.

Harvey B. Slaybaugh, assistant secretary of the American Arch Company since 1910, has been elected secretary of the company. Mr. Slaybaugh was born in 1872 at Wooster, Ohio. He was educated in the public schools at Kingsville, Ohio, and Oberlin College. In 1893 he entered the service of the Lake Shore & Michigan Southern at Norwalk, Ohio, and worked in the locomotive department. He served in various capacities as timekeeper, stenographer, accountant and storekeeper to January, 1899, at which time he was transferred to the office of the superintendent of motive power. In 1908 he was appointed chief motive power clerk, in charge of both locomotive and car work. In July, 1910, he left railway service to become assistant secretary of the American Arch Company, which position he held until his election as secretary.

H. B. Slaybaugh

Thomas Dunbar, Sr., who was recently elected president of the Acme Supply Company, Chicago, has been connected with the railway supply field since 1885. He entered the service of the Pullman Company as a car builder and was later a template maker. In 1893, he was promoted to general foreman, and in 1902 became superintendent. Two years later he was advanced to manager of the works of this company and in 1910 was appointed manager of the mechanical department. He resigned this latter connection in April, 1916, and spent the interval between his resignation and present election recuperating on his ranch in Arizona. He succeeds H. H. Schroyer, retired.

T. Dunbar, Sr.

At a special stockholders meeting of the Milwaukee Refrigerator Transit & Car Company, held Saturday, April 7, a sale of the entire business of this company to the Marsh Refrigerator Service Company was authorized, effective May 1. The latter company was recently incorporated with a capitalization of $800,000 for the purpose of taking over the business formerly conducted by the Milwaukee Refrigerator Transit & Car Company. The business will in future be under the active management of H. W. Marsh, who has been identified with the old company for seven years as its vice-president and general manager. The officers of the new company are H. W. Marsh, president; Oliver C. Fuller, vice-president, and J. J. O'Connor, secretary. The new company will continue to operate the refrigerator car lines and will manufacture, sell, repair and lease refrigerator cars as well as rebuild and repair all classes of railroad freight cars at its

Milwaukee car shops. Owing to the increasing demand for refrigerator cars equipped with steel underframes the new company proposes to invest a considerable sum of money in steel underframes, standardizing and modernizing its entire equipment. The general policy and conduct of the business will remain unchanged.

J. W. Kelker, who has been appointed mechanical engineer of the Pilliod Company, was born October 12, 1882, at Denver, Col. He was educated in the public schools of that city, and entered railroad service August 24, 1898, as a messenger to the superintendent of motive power of the Denver & Rio Grande at Denver. On December 4, 1899, he was made a machinist and drafting apprentice in the locomotive department, serving until February 16, 1903, at which time he left railroad service to enter the employ of the American Locomotive Company, at Dunkirk, N. Y., as locomotive draftsman. On July 7, 1907, he was transferred to the general drawing room at Schenectady as assistant engineer, and it is this position he leaves to take up his new duties with the Pilliod Company.

J. W. Kelker

Frank N. Grigg was recently elected manager of sales for the car department of the Harlan & Hollingsworth Corporation. He succeeds Henderson Weir, deceased, in that capacity, but does not succeed him as secretary, as was incorrectly reported in the April issue of the *Railway Mechanical Engineer*. Mr. Grigg was born at Richmond, Va., August 9, 1876, and was educated in the public schools of that city. He entered the service of the Chesapeake & Ohio at Richmond, Va., in February, 1892, working in the motive power and stores departments. He left that road in January, 1903, to go with the Adams & Westlake Company of Chicago as sales representative in the eastern territory, with headquarters at Philadelphia. In January, 1913, he became district manager of the Standard Heat & Ventilation Company, with headquarters at Washington, D. C., but in January, 1914, left the service of that company and opened offices at Richmond, Va., representing in the southeastern territory the Acme Supply Company, the Heywood Brothers & Wakefield Company, and the Transportation Utilities Company, which accounts he will continue to handle in connection with his duties as manager of sales for the car department of the Harlan & Hollingsworth Corporation. Mr. Grigg's headquarters will be as heretofore at 1201 Virginia Railway and Power building, Richmond, Va.

F. N. Grigg

Leslie W. Millar, formerly sales manager of Fahn-McJunkin, Inc., New York City, has been appointed special railroad representative of the Mark Manufacturing Company, Chicago. He was born at Boston, Mass., March 22, 1879, and graduated from the Massachusetts Institute of Technology, with the degree of bachelor of science, in 1902. He was engaged on various engineering works from that time until 1904, when he became connected with the Edison Electric Illuminating Company, Boston, Mass., as assistant erecting engineer. In 1909, he became associated with the Good Products Company, Chicago, as eastern sales agent, and in 1911 returned to the Edison Electric Illuminating Company as efficiency engineer. In 1913 he resigned to become eastern representative of the Barco Brass & Joint Company, Chicago, which position he held until January, 1917, when he became sales manager of Fahn-McJunkin, Inc.

L. W. Millar

James Buchanan Brady, vice-president of the Standard Steel Car Company and one of the railway supply field's great salesmen, died at Atlantic City, April 13. Mr. Brady was born in New York City, August 12, 1855, and was a life-long resident of that city. He was educated in its public schools and began his business life as a messenger boy in the offices of the New York Central Railroad. He soon afterward found employment with the firm of Manning, Maxwell & Moore, and very soon showed a decided salesmanship ability, and it was through that channel that he grew into national prominence. After he was with Manning, Maxwell & Moore a number of years he became identified with the Fox-Pressed Steel Company, subsequently the Pressed Steel Car Company. He became associated with the Standard Steel Car Company upon its organization 15 years ago and was its vice-president from its organization up to the time of his death. Mr. Brady was also president and director of the Independent Pneumatic Tool Company, vice-president and director of Manning, Maxwell & Moore, Inc.; president and director of the Thermoton Company, director of the United Injector Company, vice-president of the Keith Car & Manufacturing Company and of the Osgood Bradley Car Company, director of the Consolidated Safety Valve Company, and he was interested in several other enterprises connected with railroad products.

J. B. Brady

Mr. Brady was known in the railway field as an exceedingly keen business man. He had an extremely wide acquaintance among the higher railway officers and was recognized as an exceptionally successful salesman of railway cars and other railway supplies.

CATALOGUES

TURRET LATHES.—A booklet recently issued by the Gisholt Machine Company contains reprints of five advertisements of Gisholt turret lathes from the American Machinist.

FLEXIBLE GRINDERS.—The Stow Manufacturing Company, Binghamton, N. Y., has issued bulletins 18 and 33 dealing respectively with its center grinder and its adjustable flexible grinders.

COOLING TOWERS.—A looseleaf booklet recently issued by the Cooling Tower Company, Inc., of New York, describes and illustrates some of the forms of cooling apparatus made by that company.

LIST OF STEEL AND OTHER PRODUCTS.—This is the title of a 52-page booklet recently issued by the Midvale Steel Company, the Cambria Steel Company and Worth Brothers Company. The book gives a complete list, alphabetically arranged, of the products made by these companies.

BALL BEARING AND INDUCTION MOTORS form the subject of bulletin 211-A issued by Fairbanks, Morse & Co., Chicago. The bulletin gives a short description of the bearing, the rotor with solid metal winding, and a vertical shaft motor. A table of standard horsepowers and speeds is also included.

FORGINGS.—Bulletin 87, recently issued by the Union Switch & Signal Company, deals with the company's forge plant. The company is able to handle expeditiously any type of forging made from open hearth, crucible, nickel, chrome, vanadium, bronze and other alloy steels. The fire on February 10 did not reach the forge plant.

WHEELS.—The American Steel Foundries, Chicago, Ill., has issued a very attractive and artistically illustrated pamphlet on the evolution of the wheel. It is written in the form of a poem, and briefly describes the development of the wheel as the means of transportation, and closes with a description of the Davis steel wheel and its advantages.

SPRAYING EQUIPMENT.—A catalogue recently issued by the Spray Engineering Company, Boston, Mass., gives a condensed summary of the principal Spraco developments. The booklet illustrates and describes the Spraco system for cooling condensing water, Spraco air washing and cooling equipment for electrical machinery, apparatus for paint spraying, sprinkling, etc.

AIR BRAKE EQUIPMENT.—The Westinghouse Air Brake Company has recently issued special publication No. 9021, on "Extra Quality Pipe Fittings for Railroad Air Brake Service." This is a carefully prepared booklet, which emphasizes the better air brake service and saving of money made possible to railroads by the use of reliable pipe fittings in all air brake work on locomotives and cars.

FLANGE OILERS.—The Detroit Lubricator Company, Detroit, Mich., has issued a catalogue treating of the Pendulum type of flange oilers. Part one is devoted to a description of the attachment and the second part treats on proper installation. A second publication called catalogue No. 37 L contains 64 pages and deals at length with the Bulls Eye locomotive lubricator and locomotive specialties.

SINGLE-PHASE MOTORS.—Motors of 1/6 to 7½ hp. are described in bulletin No. 41,514 of the Sprague Electric Works of General Electric Company, New York. The motors are of the BSS type, varying speed, and represent the latest step in the commercial development of small single phase motors. Numerous illustrations are used to show the application of BSS motors to various machines.

STEEL PLATFORMS FOR ELEVATING TRUCKS.—Bulletin No. 37, recently issued by the McMyler-Interstate Company, Bedford, Ohio, illustrates that company's steel platforms for use with hand operated elevating trucks. These steel platforms have the advantage over wooden platforms of strength, compactness, suitability for stacking, and of course they are less liable to damage by fire than wooden platforms.

OVERHEAD HAND-TRAVELING CRANES.—Catalogue P, issued by the Brown Hoisting Machinery Company, Cleveland, Ohio, describes that company's line of Brownhoist overhead hand-traveling cranes. The booklet in its 36 pages shows the construction of the cranes and trolleys, and contains a large number of illustrations of the cranes, of their essential parts, also of some of the shops in which this equipment has been installed.

STEAM ROAD ELECTRIFICATIONS.—This is the title of a booklet published by the Ohio Brass Company, Mansfield, Ohio. Well chosen photographs and short explanations describe seventeen steam railroad electrifications on which Ohio brass materials have been used. The book is really a short review of all electrification work in this country. The photographs are excellent and the composition of the booklet a work of art.

CRANES.—The Whiting Foundry Equipment Company, Harvey, Ill., has recently issued Catalogue 127, descriptive of the company's line of cranes of all types for every service. The booklet contains material relative to electric traveling cranes, locomotive and coach hoists, gantry traveling cranes, etc. Views are given of the cranes and their details, and one-half of the 48 pages are devoted to views of the Whiting cranes at work.

THOR TOOLS.—The Independent Pneumatic Tool Company, Chicago, has issued catalogue No. 10, containing 94 pages descriptive of its pneumatic and electric tools used for drilling, reaming, tapping, flue rolling, riveting, shipping and other work of a similar character. In addition to illustrations of the tools described, the catalogue contains tables of properties, dimensions and weights and other information of interest in connection with the tools.

REDUCING VIBRATION AND NOISE.—This is the title of a booklet recently issued by the Armstrong Cork & Insulation Company, Pittsburgh, Pa., to show the excellencies of Nonpareil cork machinery insulation. This insulation is used for reducing the noise and vibration of fans, motors, printing presses and machinery generally. The booklet emphasizes the necessity for eliminating this noise and vibration in so far as possible, and show with illustrations how Nonpareil insulation secures the desired results.

TENDER TRUCKS.—A pedestal truck with side frames spring supported is described in Bulletin 113 issued in February by the Economy Devices Corporation. Two types are described, one for passenger and fast freight service, the other for switching and slow freight service. Both have side frames supported by triple helical springs resting on box yokes enclosing standard M. C. B. journal boxes. By the use of this box yoke, hinged to the side frame, the necessity for special journal boxes has been obviated and pedestal wear eliminated. Side frames are of cast steel, U-section throughout.

VACUUM PUMPS.—The Ingersoll-Rand Company has recently issued two new catalogues on dry vacuum pumps, Form No. 3037 covering the straight line type, and Form 3038 the duplex type. Both machines are equipped with "Ingersoll-Rogler" valves, are capable of maintaining a high vacuum and will handle discharge pressures of several pounds. The maximum degree of vacuum possible varies with the different machines to within 6 in. of the barometer. Both steam and power driven pumps in a large range of sizes and capacities are listed. The catalogues are profusely illustrated in colors to show the machines in whole and in section.